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PORT OF CHURCHILL
POTENTIAL FOR DEVELOPMENT

VOLUME I: REPORT

Prepared for:

Department of Transport
and
National Harbours Board

Prepared by:

Hedlin, Menzies & Associates Ltd.
and
Gibb, Albery Pullerits & Dickson

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TABLE OF CONTENTS

Page

PART III
TECHNICAL PROBLEMS OF FURTHER DEVELOPMENT

PART IV
PRACTICAL PROGRAMME FOR INCREASING PORT TRAFFIC

LIST OF TABLES

LIST OF FIGURES

PREFACE

This study is concerned with determining the most probable traffic volumes which potentially might utilize the Port of Churchill to 1985. In the past, traffic flows through the port have been of three types -- exports, imports and coastal trade. The approach which was adopted for determining future traffic flows encompasses three separate stages of analysis. First, the market potential of the port to serve the different types of commodity movement to 1985 was determined. Second, the physical factors which might limit the port's ability to fully serve the projected market potential were identified. Third, after the market potential and limiting factors were fully considered, a realistic volume of port traffic from 1970 to 1985 was arrived at and a two phase development programme for attaining this volume of traffic recommended.

In paying tribute to the numerous individuals and agencies who have assisted us in this study, we wish to particularly express our appreciation to the firm of Gibb, Albery Pullerits & Dickson of Toronto, who worked in association with us. Assistance was also provided by the Canada Transportation Service of Winnipeg. Valuable assistance and constructive comments were received from members of the Department of Transport, the National Harbours Board, the Canadian Wheat Board, the Manitoba Royal Commission on Northern Transportation, the Hudson Bay Route Association and from a number of provincial government departments in Manitoba, Saskatchewan and Alberta. Appreciation is expressed

for all the assistance and constructive comments received and which have played an important part in the preparation of this study.

However, the views, conclusions and recommendations contained in this report are those of the members of Hedlin, Menzies & Associates Ltd. and the firm accepts full responsibility for them.

HEDLIN, MENZIES & ASSOCIATES LTD.

Winnipeg, Manitoba,
January, 1969.

SUMMARY

Introduction

The Port of Churchill is located at the mouth of the Churchill River on the shore of Hudson Bay within the Hudson Bay Low Land. It lies just north of the tree line. The summers are short and cool, the winters long and extremely cold and on the average there are only 63 frost free days per year. A major impediment to the use of the port has been the severe climatic conditions which create several different types of ice hazards which in turn have restricted the open season at the port to an average of 82 days per year, normally from July 26 to October 15. Throughout the history of the Port of Churchill and the Hudson Bay Route, grain exports and more specifically wheat exports have formed the bulk of port traffic.

Historical Function

In the recent past, that is from 1958 to 1966 an average of 710.3 thousand tons of commodity traffic moved through the port per year. Outbound traffic in this period accounted for 93.0 per cent of total port activity (see Table A).

Commodities moving to and from the Port of Churchill consist of two different types of shipping, coastal and offshore. Coastal shipping is comprised of commodities moving between Canadian ports. Offshore shipping consists of commodities arriving from a foreign port or destined for a foreign port.

TABLE A

PORT OF CHURCHILL - COASTAL AND OFFSHORE SHIPPING
(thousand short tons)

				Per Cent of Total Handlings			
				Coastal		Offshore	
	Total Handlings			Load-	Unload-	Load-	Unload-
Year	Coastal	Offshore	Total	ings	ings	ings	ings
1958	28.2	619.6	647.8	1.0	3.3	90.8	4.9
1959	36.4	687.5	723.9	1.9	3.2	89.2	5.8
1960	14.1	663.1	677.2	2.1	-	87.3	10.6
1961	38.7	626.4	665.1	3.1	2.7	88.9	5.3
1962	29.0	708.4	737.4	2.2	1.8	88.9	7.1
1963	37.9	738.0	775.9	4.9	-	87.7	7.4
1964	20.3	691.2	711.5	2.6	.3	91.8	5.3
1965	6.0	761.1	767.1	.8	-	96.6	2.6
1966	13.8	673.3	687.1	2.0	-	95.4	2.5
9 year average	24.9	685.4	710.3	2.3	1.3	90.7	5.7

Of the total commodities handled from 1958 to 1966 at the Port of Churchill, only 3.6 per cent was received from or destined for Canadian ports, the remainder, 96.4 per cent originated at or was destined for foreign ports. Outbound international shipments of wheat alone account for most of the commodity traffic handled at the port in international seaborne shipping and during the last nine years have accounted for 99 per cent of such commodities. Relatively small and sporadic quantities of mineral products and miscellaneous cargo represent the remaining outbound commodities.

The Port of Churchill throughout its history has functioned primarily as a staging area for handling wheat from Saskatchewan destined for export to Western Europe. Exports of Commodities other than wheat have been negligible. Imported commodities handled and commodities

handled in coastwise shipping also have been in minute quantities compared to the volume of wheat handled.

The port's past and present function has been and remains primarily one of serving western Canadian grain producers and grain buyers in the United Kingdom and Western Europe. It was for the purpose of developing an alternate route for grain exports that the Port of Churchill was established. Throughout its history the port has not significantly deviated from this basic function by becoming more diverse in the commodities handled or regions served.

Port Facilities

The grain and ship handling facilities at the port are considered to be adequate within the context of today's technology and the quantity of grain being shipped. However, they may impose limitations in the expanded use of the port in the future if cleaning facilities and work practices remain unchanged.

Market Potential

The market potential of the port is that volume of traffic which in the future will be generated in the areas now served and which might gain a market advantage by being exported via the Hudson Bay Route. The commodities or commodity groups which were assessed in determining this potential are as follows:

- grain
- forest products
- base metals

- petroleum
- potash
- general cargo
- commodities carried in coastal shipping

It is concluded that in the period studied, i.e. from 1970 through 1985, there is little likelihood that any potash or petroleum will be exported through Churchill. The potash markets in Europe, which the port could serve, would more likely receive required potash supplies from more economic sources of supply -- production areas in the United Kingdom and continent. Domestically produced petroleum could not effectively compete in European markets because of high production costs and was therefore excluded as a potential export through the Port of Churchill.

The commodities which were considered as potential port traffic include grain exports, base metal exports, forest product exports, general cargo imports and supplies for northern settlements carried in coastal shipping. Production possibilities in the prairie agricultural area served by the port and export prospects in offshore markets which would be served through the port, suggest substantial traffic in wheat, feed grain and oilseed exports. Production of forest and mineral resources in Manitoba and Saskatchewan could potentially be shipped through the port to the United Kingdom and Western Europe but because of forwarding costs and market outlook it is not expected that the volume of these particular commodities will be substantial and the effect on total

potential traffic through the port will not be very great.

That portion of the prairie region which can import consumer and industrial commodities from the United Kingdom and Western Europe at a transportation cost advantage by using the Hudson Bay Route is, and will remain, essentially a primary producing, relatively low population area. The import needs for such commodities and potential traffic of these import commodities through Churchill is directly related to future population and industrial activity in this area. Foreseeable population growth and industrial activity, at least through 1985, indicates that this type of import traffic will not assume a major role relative to the total market potential of the port.

That portion of potential port traffic which might be carried in coastal shipping and destined for the supply of northern settlements is difficult to predict with any certainty, but at best can not be expected to contribute significantly to the total potential of the port.

Potential Traffic Assuming Year Round Operation

Assuming a 12 month navigation season and that port facilities would not restrict shipping in any way, total potential inbound and outbound traffic has been projected for 1985 at a minimum of 1.4 million tons and at a maximum of 2.5 million tons. Because of the uncertainty of domestic factors of production in the future and a wide range of export market prospects, the scope of potential traffic possibilities is very wide. The medium or most probable projection for potential traffic

in 1985 is approximately 1.9 million tons, an increase of 1.2 million tons or 170 per cent over the current traffic volume which has averaged approximately 710 thousand tons annually from 1958 through 1966. Details of this most probable traffic forecast by commodity type is shown in Table B.

TABLE B

POTENTIAL INBOUND AND OUTBOUND TRAFFIC 1970-1985
- PORT OF CHURCHILL
(probable projection - thousand tons)

	1970	1975	1980	1985	Per Cent 1985
Grain	1,300	1,400	1,500	1,600	83.9
Forest Products	75	75	75	75	3.9
Base Metals	50	50	50	50	2.6
Petroleum	-	-	-	-	-
Potash	-	-	-	-	-
General Cargo	149	155	161	167	8.8
Coastal Shipping	9	10	13	15	0.8
Total	1,538	1,690	1,799	1,907	100.0

The above projections could only be considered as potential if the port remained open throughout the year and facilities existed which were able to handle the projected volumes. Within the current port operating season and with the existing port facilities only a portion of this potential traffic could be handled if no adjustment were made in cleaning facilities and present work practices.

Potential Traffic with Reduced Operating Season

If the port were not open for a full year it would, of course, significantly reduce the potential traffic forecast as the restrictions

imposed by a limited navigation season would affect to a varying degree all specific types of traffic.

It is concluded from an examination of available evidence that if the present port facilities are not changed and the navigation season is not extended, the total traffic moving through the port by 1985 will at most probably increase only by some 40 per cent over the average of the last nine years; or from approximately 710 thousand tons per year to 997 thousand tons in 1985.

The two levels of projected traffic in 1985 are shown in Table C, which also indicates the commodities and type of traffic which would account for the increases.

TABLE C

PORT OF CHURCHILL - FORECAST TRAFFIC
PRESENT AND EXTENDED NAVIGATION SEASON
(thousand tons)

		Projected to 1985	
	Average 1958-1966	Assuming All Year Operation	Assuming Present Season
Grain	641	1,600	909
Forest Products	-	75	-
Base Metals	3	50	15
Petroleum	-	-	-
Potash	-	-	-
General Cargo	41	167	58
Coastal Shipping	25[a]	15	15
Total	710	1,907	997

[a]Includes coastal traffic which was generated by the mining operation at Rankin Inlet.

Limiting Factors

The major limiting factor which will restrict the volume of potential traffic in the future is the period of time in which the port could be operated on an economical basis using conventional unstrengthened and strengthened surface vessels. The possibility of using various new types of transportation in the foreseeable future was assessed and found to be impractical. The new methods of transportation which were considered and found not to be economically feasible are containerization, air cushion vehicles and cargo submarines.

It is technically possible to navigate the Hudson Bay Route throughout the year using conventional strengthened vessels with icebreaker assistance. However, the cost of providing sufficient icebreaker service and other related technical aids would make 12 month operation uneconomic. For example, if the port were to remain open all year, fully ice strengthened vessels with icebreaker assistance would be required and perhaps a tidal barrier would have to be constructed. The annualized cost of providing the foregoing requirements coupled with the cost of carrying the present investment at Churchill, related to the potential grain exports in 1985, would be as follows:

Assuming All Year Operation	Bushels (millions)	Annual Average Cost per Bushel (¢/bu.)
With fully strengthened vessels and icebreaker escort	64.0	19.0
With tidal barrier fully strengthened vessels and icebreaker escort	64.0	19.3

It is possible to extend the season at the port by 23 days without a major investment using conventional vessels, although a tidal barrier might be required. The total annual cost of carrying this investment related to potential grain exports for the 105 day port season would not require the inclusion of strengthened vessels or icebreakers. The average cost per bushel of throughput in 1985 assuming this 105 day season would be as follows:

Assuming 105 Day Operation	Bushels (millions)	Annual Average Cost per Bushel (¢/bu.)
Without tidal barrier	36.4	9.6
With tidal barrier	36.4	10.2

The present annual cost of the existing investment at Churchill, related to an average annual throughput of 20 million bushels representative of recent grain traffic in the 82 day operating period, is approximately 17.5¢ per bushel.

Assuming investment at Churchill (including the railway, town, etc.) is some $70 million, at approximately 5 per cent interest this would mean an annual carrying charge for existing facilities of some $3.5 million. This cost allocated over 909 thousand tons or 36.4 million bushels of grain exports would amount to 9.6¢ per bushel. If a tidal barrier would be required to extend the season to 105 days then an additional investment of $2.9 million would be needed. The annual cost of carrying the investment for the tidal barrier would be approximately $219.6 thousand or an additional .6¢ per bushel based

on an annual throughput of 36.4 million bushels.

The examination of port navigation seasons of other lengths indicates that the technical costs of operating the port for any season in excess of 105 days cannot be justified in economic terms and furthermore, the season of 105 days in relation to potential traffic would result in the lowest cost per unit of throughput.

A Recommended Programme for Development

It is concluded that the most technically and economically feasible way in which port utilization can be increased in the future is to extend the period of time in which the port remains open to navigation by approximately three weeks from the present 82 to 105 days. The least costly way this can be accomplished would be to remove the early ice problem at the wharfs which occurs in the fall. This problem is created by the early formation of slush or frazil ice in the Churchill River above the port. The weight of this ice carried by the river current to the wharfs at the port can force ships from their moorings.

There is a distinct possibility that the problem created by frazil ice in the river will be solved in part or completely when some of the water flow of the river is diverted to the Nelson River system as part of the Manitoba Hydro's power development at Kettle Rapids. Whether the problem will or will not "solve itself" will be known in 1973. Because of this possibility a two phase development programme is recommended for the Port of Churchill as follows:

a. The first phase would consist of a short term traffic promotion programme to 1973 involving a minimum investment and the continuation of the present port operating season.

b. The second phase would consist of a long term development programme implemented after 1973 and which would involve an extension of the navigation season to 105 days and perhaps involving a more substantial investment.

First Phase Development Programme (to 1973)

Until the frazil ice is eliminated, that is, for the duration of the short term development programme, the port operating season would remain the same as at present. Such a development programme to 1973, involving minimum investment would be directed to increasing port traffic within the present operating season to the point where the port facilities are operating at capacity.

In the past, the combination of a short navigation season, availability of markets and forwarding costs have all limited the volumes of commodities handled at the port. For example, of the total savings in actual forwarding costs on wheat exports to the United Kingdom through Churchill, only about 50 per cent goes to the buyer. This has been equivalent to an average saving of 5.0 cents per bushel. Even with a saving of this amount, buyers in the traditional markets served by Churchill have been hesitant and have never ordered sufficient wheat through Churchill to test the capacity of the port.

It is not considered that it would be in the public interest to increase the capacity of the port until such expansion was required

to accommodate traffic which would in fact materialize. In the past total port traffic has been adequately handled without operating the port facilities to the limit of their capacity. In light of this, it is considered that the period up to 1973 should be used to assess the present working capacity of the port within the existing operating season and to determine if traffic could be increased in response to market forces.

Increasing wheat exports through the port would be the most rational way in which the port could achieve maximum capacity. Wheat is the single major commodity which now moves through the port in volumes which are directly influenced by public policy and so could be used to test the reaction of buyers if they were offered a larger proportion of the total savings in forwarding costs.

Once the capacity of the port is reached the full implications to national policy of any further expansion programme could be fully assessed before undertaking the second phase of development after 1973.

Second Phase

A bottleneck which may limit the port's capacity to handle additional grain exports after 1973 is the cleaning facilities. A difficulty in the processing of wheat through the terminal elevators has been to clean to the standards which are now required by the Board of Grain Commissioners. Wheat is currently exported through the port and is comprised largely of Number 2 Northern. The established standards

of this grade are quite high and before the wheat can be loaded on vessels it must at times be passed two or three times through the cleaning facilities. This problem may be avoided in the future by a change in the grading standards, or by exporting substantial quantities of grains requiring less thorough cleaning as in the case of feed grains.

If, after 1973 the problem of frazil ice in the harbour solves itself, and the cleaning bottleneck is removed by a change in the types of grain handled, a different grading system or an expansion of the cleaning facilities, capacity would increase.

With this anticipated bottleneck removed, the most probable export potential of the Churchill Hinterland could be handled by the existing rail and ocean transportation systems within a port operating season of 105 days extended to November 7th. No investment would be required for icebreakers and vessels with the ice strengthened hulls. Thus, with a short extension of the navigation season and minimum investment, port traffic could increase to a level of almost 1.7 million tons by 1985 if sufficient demand for the port's facilities was to materialize (see Table D).

However, if present trends in shipbuilding technology continue, major investments in port facilities may be required in order to accommodate significantly larger ships. Without such investment, Churchill's competitive position may be eroded.

TABLE D

PROJECTED POTENTIAL TRAFFIC
RECOMMENDED DEVELOPMENT PROGRAMME
(thousand tons)

	Phase 1	Phase 2		
	1970-1973	1975	1980	1985
Grain	909	1,400	1,500	1,600
Forest Products	-	-	-	-
Base Metals	15	15	15	15
Petroleum	-	-	-	-
Potash	-	-	-	-
General Cargo	58	58	58	58
Coastal Shipping	15	15	15	15
Total	997	1,488	1,588	1,688

Recommendations

After 1973, it is expected that even though there would be no physical limitations to handling any foreseeable grain exports, there still could be some buyer hesitancy to order the volumes forecast for 1985 within the 105 day season. If this were the case, perhaps increased incentives through allowing buyers a greater forwarding cost advantage would have to be provided to achieve the maximum grain export potential.

It is therefore recommended that any direct development expense at the port be delayed until at least 1973 when the results of the first phase development programme can be assessed and the implications to regional and national interests determined. Prior to that date, development activity should be directed to examining and implementing the means by which grain exports through Churchill can

be increased to the present working capacity of the port within the existing navigation season. The most direct method would be to allow buyers a greater forwarding cost advantage relative to other Canadian ports.

PART I

DESCRIPTION OF THE PORT AND ROUTE

CHAPTER 1

DESCRIPTION OF THE PORT AND ROUTE

Development of the Route

Prior to World War I there existed only one route for the export of grain from the Canadian prairies. This was the eastern route which included shipment from ports on the Great Lakes, St. Lawrence River and Atlantic Coast. Periodically this grain export route became congested. In the early years of this century the western farmer increasingly demanded that alternate routes for the export of western grains be opened which would involve a shorter and less costly internal rail haul.

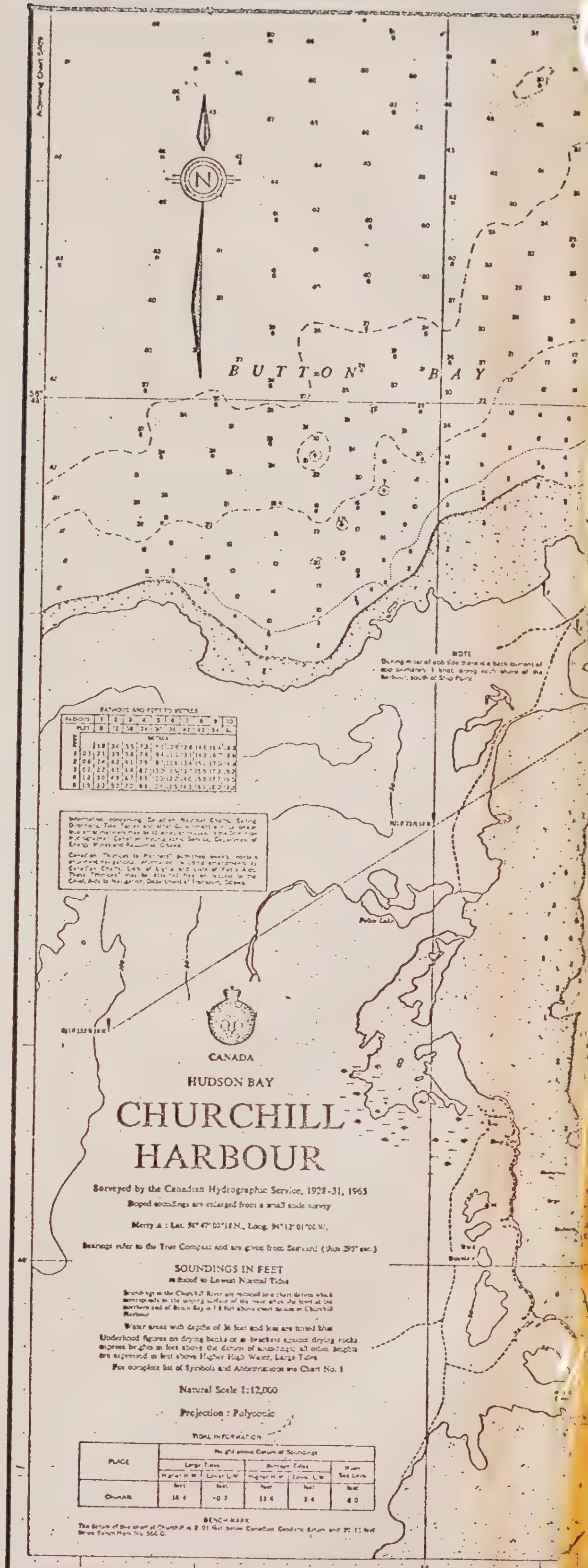
By the start of the first World War, the Panama Canal had just been completed and would soon offer an alternate route for Alberta producers through the Pacific ports and the Canal to the traditional markets in Europe. The Government of Canada responded to demands from Saskatchewan producers for an alternate route with a shorter rail haul to the United Kingdom and Western Europe and in 1911 initiated construction of a railway to the Hudson Bay. As was stated in the 1914 Canada Year Book:

> "The enormous quantity of grain grown in Western Canada and the difficulty of shipping it all by the eastern route - a difficulty enhanced by the shortness of the period of navigation and the long rail haul from the grain fields to the Atlantic - constitute conditions which have led to the hope - practically universal in the west - that to the grain growers of Alberta the opening of the Panama Canal, and to the grain growers of Saskatchewan the opening of the Hudson Bay route, will be an immense gain."

In 1912, construction of a port on Hudson Bay at the mouth of the Nelson River was started in order to complete the Hudson Bay Route but it was discontinued in 1917 due to the heavy demands of World War I on public finances. After World War I the port project on the Nelson was reassessed. It was decided on the basis of an engineering study (The Palmer Report) that a port at Churchill would be more desirable because of the physical disadvantages of a shallow and exposed harbour at the mouth of the Nelson River. The proposed port site at Churchill offered a sheltered and relatively deeper harbour. Construction of the Hudson Bay rail line was redirected to Churchill and construction of the Port of Churchill commenced. The rail line and the initial port facilities were completed in 1929 and in 1930 a token cargo of wheat was shipped from the Port of Churchill.

Season and Climate

The Port of Churchill is located at the mouth of the Churchill River on the shore of Hudson Bay (see Figure 1). The Port, in geological terms, is situated within the Hudson Bay Low Land. It lies just north of the tree line and the natural vegetation of the area is comprised mainly of lichens, mosses, grasses, and sedges which are characteristic of arctic tundra. The summers are short and cool, the winters long and extremely cold and on the average there are only 63 frost free days per year. The Port's exposure to the severe climatic conditions acts as a major impediment to development as these climatic conditions create several different types of ice hazards


BUTTON BAY
CANADA
HUDSON BAY
CHURCHILL
HARBOUR
Surveyed by the Canadian Hydrographic Service, 1928-31, 1965
SOUNDINGS IN FEET
Natural Scale 1:12,000
Projection : Polyconic

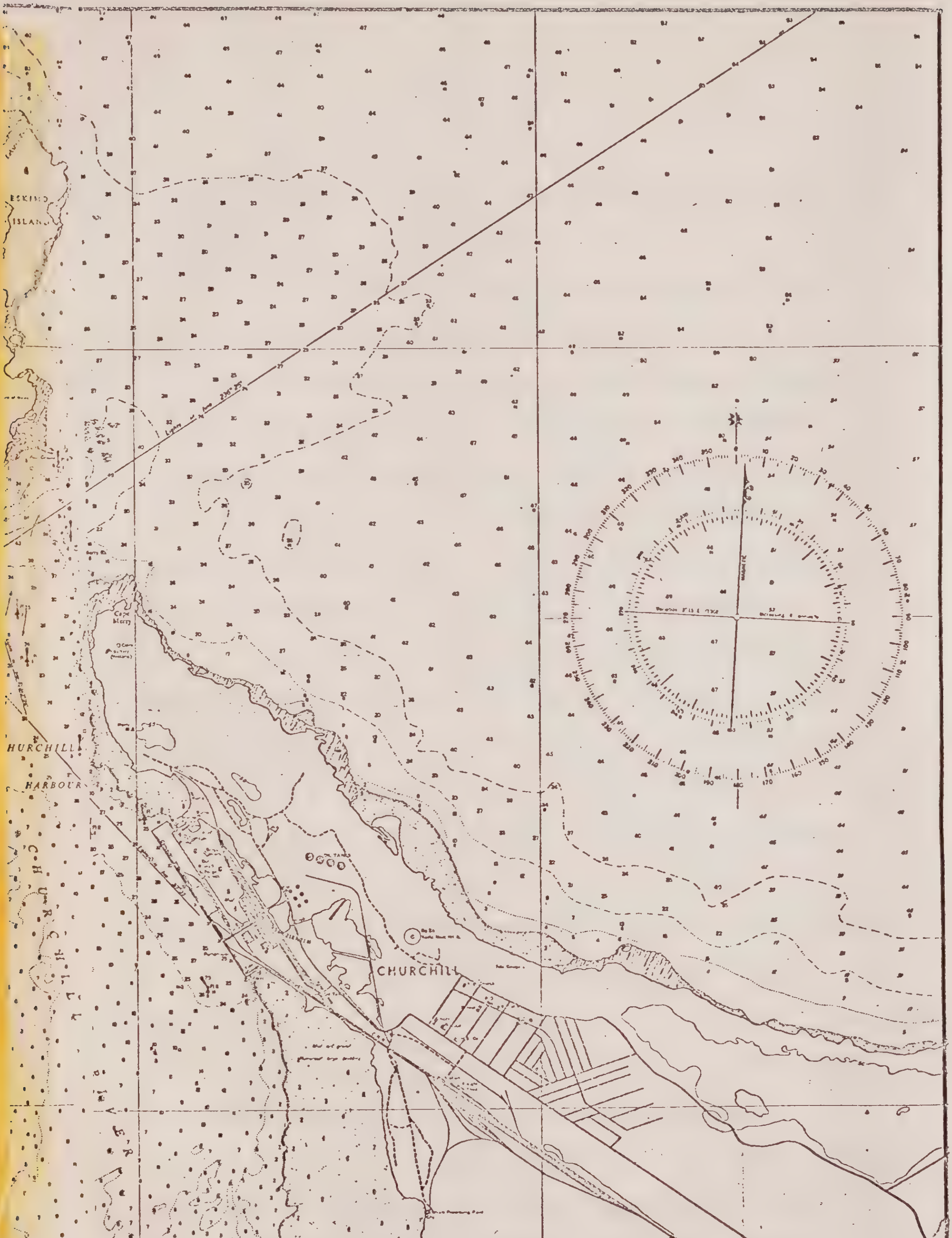

ESKIMO
ISLAND
HURCHILL
HARBOUR
Cape Merry
CHURCHILL
LONGITUDE 94° 10' WEST FROM GREENWICH

FIGURE I

which have restricted the open season at the Port to an average of 82 days per year from July 25 to October 15.

Before, after and during the open season, the climate at the Port in the Hudson Bay and in the Hudson Strait all affect navigation in various ways. For example, temperatures in Hudson Bay are more extreme than in Hudson Strait where they are moderated by the influence of the Atlantic Ocean. Normal mean monthly temperatures at Churchill range from -17°F in January to 54° in July. The corresponding range of temperatures at Resolution Island at the eastern end of Hudson Strait is -1°F and 38°F during the same month.

Strong winds are more prevalent in the Bay than in the Strait. At Churchill strong winds are most common in the months of September, October and November and are almost invariably from a northwesterly quarter. Fog with visibility less than 5/8 mile is common during the months of July and August in Hudson Strait, particularly at the eastern end. Fog is less common during the month of May, June and September and rare during the period October to April inclusive.

Precipitation is moderate, averaging 14.25 inches at the Town of Churchill, of which 4.52 inches is in the form of snow. Blowing snow, with visibility less than six miles, is common during the winter, particularly during the months of November and December.

As a result of the variable effect of climate, during the existing navigation season the main adverse climatic factors, other than ice, are fog in Hudson Strait and strong winds at Churchill.

Prior to the existing season fog and strong winds are both less frequent. Subsequent to the existing season fog is rare, but strong winds and blowing snow are more frequent.[1]

Nature of Commodity Shipments

Throughout the history of the Port of Churchill and the Hudson Bay Route, grain exports and more specifically wheat exports have formed the bulk of port traffic. From 1958 to 1966 an average of 710.3 thousand tons per year of commodity traffic moved through the Port. Outbound traffic in this period, which was mainly wheat, accounted for 93.0 per cent of total Port activity (see Table 1).

Commodities moving to and from the Port of Churchill are carried by two different types of shipping, coastal and offshore. Coastal shipping consists of commodity traffic moving between Canadian ports. A vessel classed in the coasting service is usually of Canadian or British Commonwealth registry and sails between two Canadian ports loading and unloading no foreign freight.[2] Offshore shipping consists of commodity traffic arriving from a foreign port or destined for a foreign port. It includes all the commodities loaded for or unloaded from foreign countries at Canadian ports.

[1]The affect of climate on the Hudson Bay Route relative to navigation is discussed in detail in Appendix A, Volume II.

[2]Coastal shipping may at times be carried in vessels of foreign registry if special circumstances prevail and a waiver to engage in coastal service has been obtained from the Department of Transport.

TABLE 1

PORT OF CHURCHILL - COASTAL AND OFFSHORE SHIPPING
(thousand short tons)

	Loadings			Unloadings			Total Handlings			% of Total Handlings			
										Coastal		Offshore	
	Coastal	Offshore	Total	Coastal	Offshore	Total	Coastal	Offshore	Total	load-ings	unload-ings	load-ings	unload-ings
1958	6.5	587.9	594.4	21.7	31.7	53.4	28.2	619.6	647.8	1.0	3.3	90.8	4.9
1959	13.5	645.4	658.9	22.9	42.1	65.0	36.4	687.5	723.9	1.9	3.2	89.2	5.8
1960	13.9	591.2	605.1	.2	71.9	72.1	14.1	663.1	677.2	2.1	-	87.3	10.6
1961	20.7	591.4	612.1	18.0	35.0	53.0	38.7	626.4	665.1	3.1	2.7	88.9	5.3
1962	16.0	655.7	671.7	13.0	52.7	65.7	29.0	708.4	737.4	2.2	1.8	88.9	7.1
1963	37.7	680.3	718.0	.2	57.7	57.9	37.9	738.0	775.9	4.9	-	87.7	7.4
1964	18.5	653.4	671.9	1.8	37.8	39.6	20.3	691.2	711.5	2.6	.3	91.8	5.3
1965	5.9	740.8	746.7	.1	20.3	20.4	6.0	761.1	767.1	.8	-	96.6	2.6
1966	13.5	655.8	669.3	.3	17.5	17.8	13.8	673.3	687.1	2.0	-	95.4	2.5
Average	16.2	644.7	660.9	8.7	40.7	49.4	24.9	685.4	710.3	2.3	1.3	90.7	5.7

Source: Dominion Bureau of Statistics, Shipping Report, Part III, 54-204
Dominion Bureau of Statistics, Shipping Report, Part II, 54-203

Of total commodity handlings from 1958 to 1966 at the Port of Churchill, only 3.6 per cent was received from or destined for Canadian ports, the remainder, 96.4 per cent originated at or was destined for foreign ports. The bulk of the coastal shipping consisted of commodities outbound from the Port. The largest single such commodity, fuel oil, averaged just over 9,000 tons annually. By-products from the grain cleaning operation at the Port's elevators represented the second largest outbound coastal volume followed by general cargo, miscellaneous cargo and gasoline. Unloadings at the Port from other Canadian ports have been of token quantities only, averaging 8.7 thousand tons annually throughout the nine year period and varying from a low of 95 tons in 1965 to a high of 22.9 thousand tons in 1959.

Outbound international shipments of wheat alone account for most of the commodity traffic handled at the Port in international seaborne shipping and during the last nine years have accounted for over 99 per cent of such commodities. Relatively small and sporadic quantities of mineral products and miscellaneous cargo represent the remaining outbound commodities.

Of the commodities originating from overseas areas and handled at the Port as inbound traffic, fuel oil represents the largest volume averaging just under 26.9 thousand tons annually from 1958 to 1966. Gasoline, general cargo and miscellaneous cargo have in the same nine year period averaged 10.8 thousand tons, 2.1 thousand tons and 915

tons respectively.

In summary, the Port of Churchill throughout its history has functioned primarily as a staging area for handling wheat from Saskatchewan destined for export to Western Europe. Exports of commodities other than wheat have been almost negligible. Imported commodities handled and commodities handled in coastwise shipping also have been in minute quantities compared to the volume of wheat handled at the Port.

Value of the Port

The Port of Churchill serves regions both in Canada and offshore through acting as a staging area for four different types of commodity movements.

- Outbound commodities exported to offshore export destinations.
- Inbound commodities originating offshore.
- Outbound commodities carried in coastal shipping.
- Inbound commodities carried in coastal shipping.

The main objective for the initial development of the Port was to serve grain producers in Western Canada. The Port was developed as a part of an alternate route for grain exports to traditional markets in the United Kingdom and Western Europe.

Since it first became operative in 1930 the main commodity handled at the Port has been wheat originating in Saskatchewan and exported to offshore destinations primarily in Western Europe. In this primary function the Port serves both the producer in Western

Canada and the buyer in traditional offshore markets. Utilization of the Hudson Bay Route offers two distinct advantages to both producer and buyer.

First, the Port provides an additional outlet for the foreign buyer of grain and provides the Prairie producer with an additional route to important markets. Second, the Port offers a saving in forwarding costs relative to grain exports destined for the United Kingdom and Western Europe over Eastern and Pacific ports. The savings in grain forwarding costs are shared by both producer and buyer. The Wheat Board through adjusting the in store price on wheat shipped through the Port of Churchill directs a portion of the forwarding cost saving to the western wheat producers. The remaining portion of the saving in forwarding cost is given to buyers ordering ex Churchill and thus acts as an incentive for them to utilize the Port when ordering wheat. Other commodities have been exported through Churchill but their contribution to total port traffic has been sporadic and insignificant.

In the past imports handled at the Port have consisted of petroleum products for local consumption at Churchill plus window glass, automobiles, binder twine, liquors, beer, confectionary, dry goods, barbed wire, iron bars, wire netting, iron and steel castings, steel balls and other miscellaneous commodities destined primarily for Saskatchewan and Manitoba. In terms of total port traffic, import commodities are very small amounting to only 5.7 per cent of total traffic from 1958 to 1966. The majority of imported commodities

originate in the United Kingdom with the remainder originating in Western Europe. By utilizing the Port of Churchill the exporter in the United Kingdom or Western Europe is able to deliver commodities to markets in Western Canada and avoid a long and costly rail haul. However, despite the shorter rail haul to markets in Saskatchewan and parts of Manitoba, import traffic at the Port of Churchill has remained of a token size. This indicates that there are disadvantages in using this route which tend to offset the relatively shorter distance.

A large part of the commodities loaded in coastal shipping at the Port of Churchill are to supply northern settlements on the west coast of Hudson Bay. The sea lift of these supplies loaded at the Port of Churchill is an extension of the Hudson Bay railway and serves to supplement supplies which are sea lifted to northern settlements directly from Montreal and other east coast ports. Coastwise cargo carried north from Churchill consists mainly of general cargo and petroleum products (fuel oil and gasoline) and amounts to a very small portion of total traffic. The remaining portion of outbound coastwise shipping consists of grain by-products from the cleaning facilities at the Ports grain elevators which are shipped to eastern Canada for animal feeds. This outbound coastal shipping in total accounts for only a very small portion of total port handlings -- averaging 2.3 per cent of total handlings from 1958 to 1966.

The fourth type of commodity movement handled by the Port are the inbound commodities carried in coastal shipping which for the most part serves to supply the Port of Churchill and adjacent communities.

At the present time this type of commodity movement is comprised mainly of general cargo although in the past there have been significant movements of nickel ores from a nickel mining operation at Rankin Inlet on the west side of Hudson Bay which terminated in 1963. However, even with the movement of nickel ore, inbound commodities in coastwise shipping averaged only 1.3 per cent of total Port activity from 1958 to 1966.

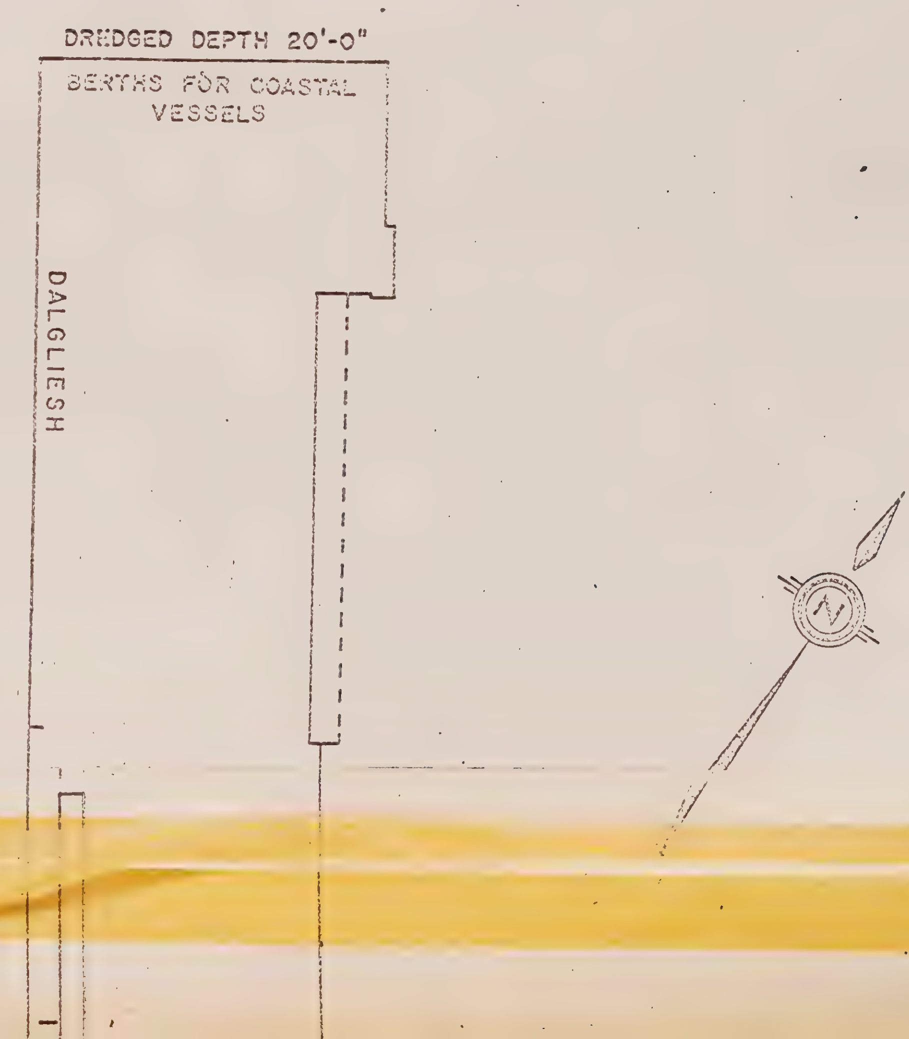
Existing Port Facilities

The layout of the main facilities is shown in Figure 2 and may be briefly described as follows:

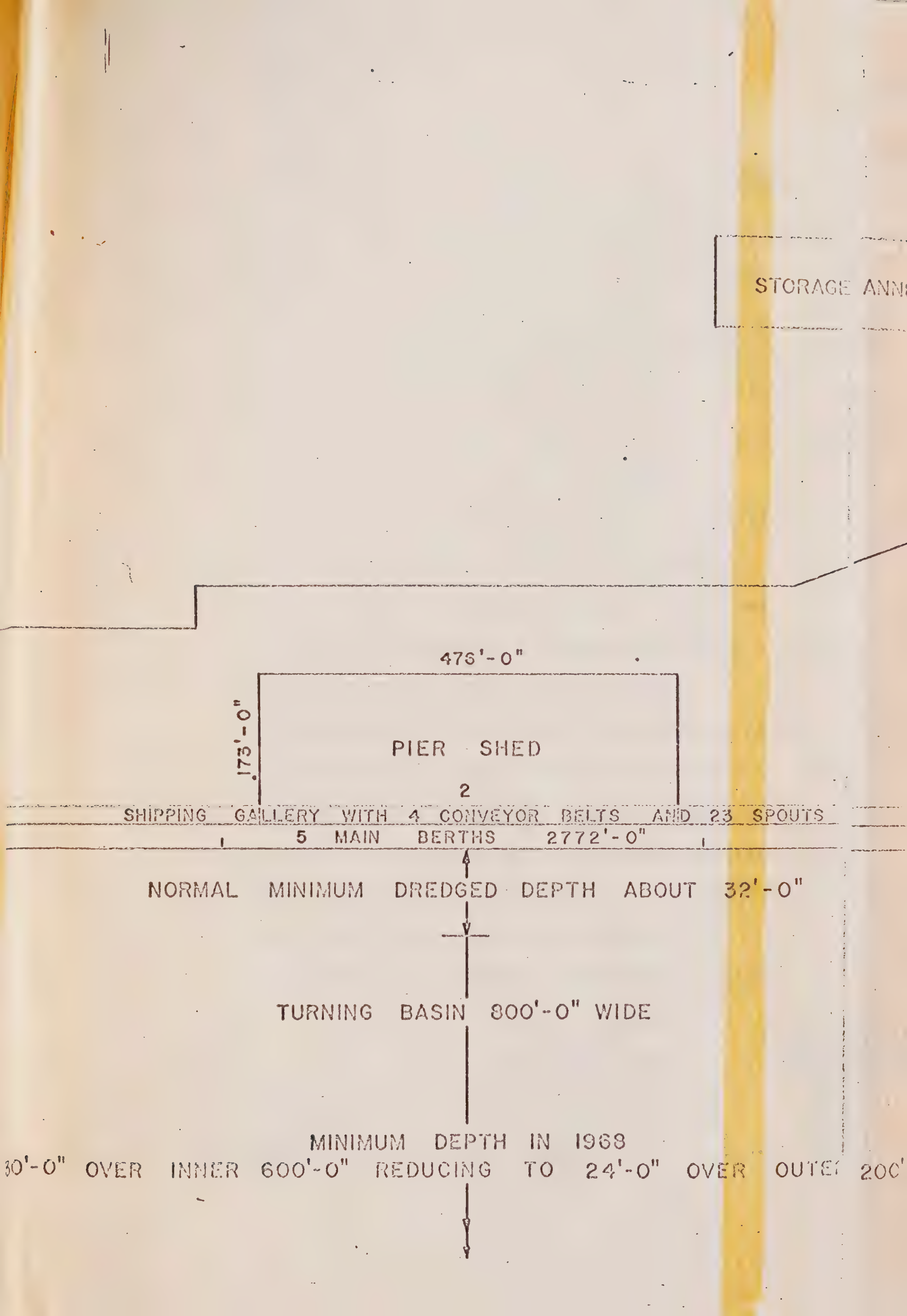
Berthing Facilities - The main wharf is 2,772 feet long and provides berths for 4 large vessels or 5 smaller vessels. These berths are dredged to a general depth of about 32 feet over a width of 100 feet from the wharf face. A turning basin with a total width of 800 feet from the wharf face has a dredged depth of about 30 feet as shown in Figure 2.

At the north end of the marginal wharf is a wharf about 300 feet long, dredged to about 20 feet deep for berthing coastal vessels.

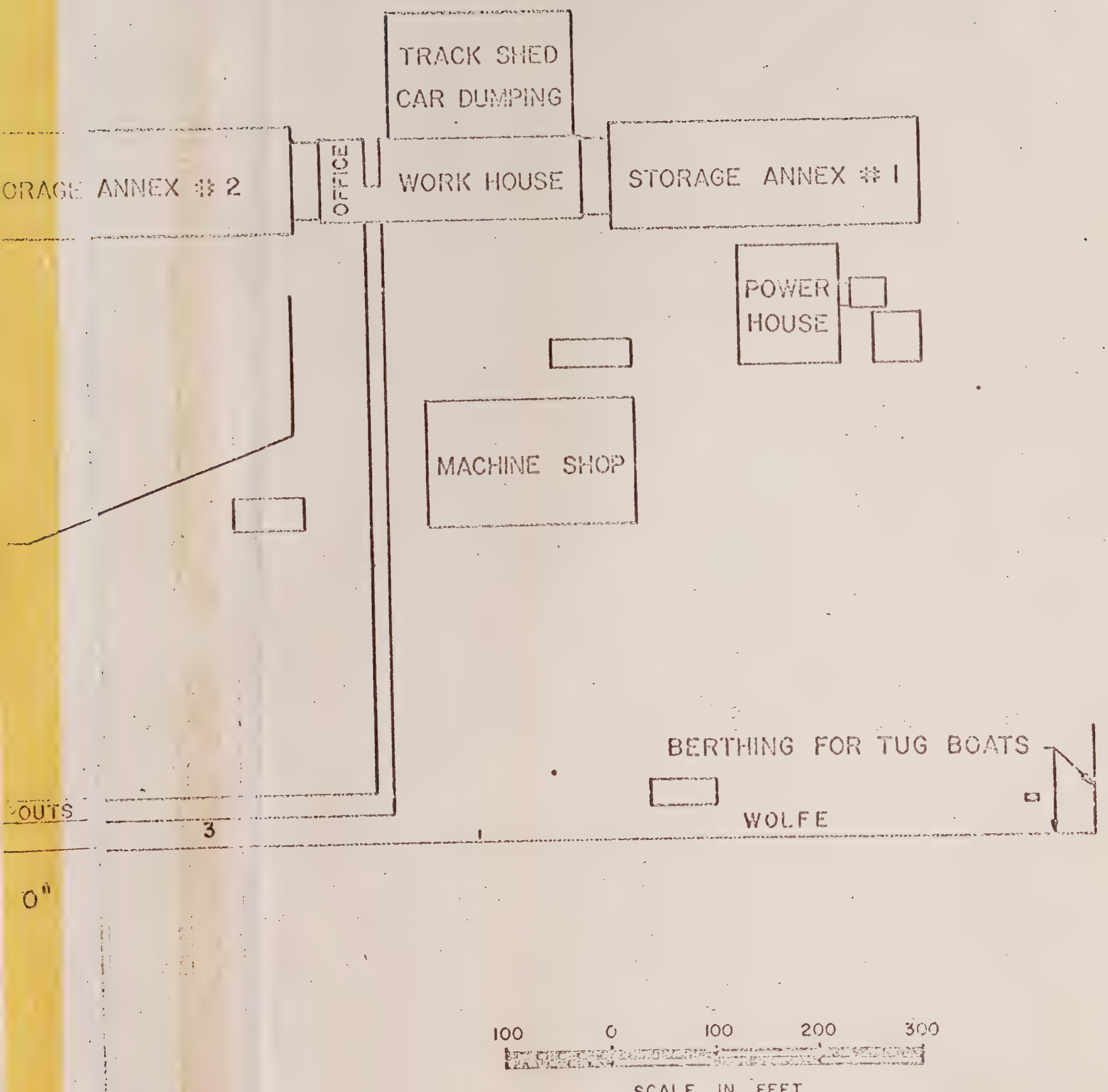
A transit shed with an area of 83,000 square feet is located immediately behind the centre of the main warf and behind the centre, one third of the grain conveyor gallery. The shed is in good condition, but its location means that vessels discharging general cargo occupy a berth which could be used for vessels loading grain.



DREDGED DEPTH 20'-0"
BERTHS FOR COASTAL
VESSELS
DALGLIESH
N



STORAGE ANN
476'-0"
173'-0"
PIER SHED
2
SHIPPING GALLERY WITH 4 CONVEYOR BELTS AND 23 SPOUTS
5 MAIN BERTHS 2772'-0"
NORMAL MINIMUM DREDGED DEPTH ABOUT 32'-0"
TURNING BASIN 800'-0" WIDE
MINIMUM DEPTH IN 1968
30'-0" OVER INNER 600'-0" REDUCING TO 24'-0" OVER OUTE 200'



PORT CHURCHILL - FACILITIES

FIGURE 2

Grain Handling Facilities - The grain elevator consists of a typical workhouse with two storage annexes of 100 bins having a total storage capacity of 5,000,000 bushels. The grain is received by rail in the Track Shed where there are four car dumpers. From the dump pits, belts convey the grain to elevators feeding weighing hoppers in the workhouse which weigh the "dirty" grain in car load lots. The grain is then elevated and conveyed either to bins serving the cleaners or to storage bins to await cleaning at a later date.

Present cleaning facilities consists of 26 Hart Uniflow Cleaners and 5 Monitor Cleaners. The grain is cleaned one, two or three times until the required maximum "dockage" is obtained. The grain is automatically sampled, and the samples are fed to a sample cleaner in the office of the Cleaning Superintendent.

The cleaned grain is conveyed to one or more of 12 bins serving the outgoing weighing hoppers each with a capacity of 2,000 bushels. From the weighing hoppers the grain is fed to one of 4 conveyor belts which deliver grain along the conveyor gallery to the shipping spouts. There is a total of 23 spouts, 4 of which would normally serve one vessel, i.e. one from each conveyor belt.

The capacity of the existing grain handling equipment is as follows:

Equipment	Rated Equipment Capacity (Bushels Per Hour)	Working Capacity Of Equipment (Bushels Per Hour)
4 Car Dumpers	40,000	35,000
4 Receiving Scales	52,000	36,000
Cleaning Equipment	40,000	17,500
4 Shipping Scales	52,000	52,000
Conveyor System	60,000	36,000

The working capacity indicated consists of the effective average throughput experienced during the past few years and, in the case of the cleaning equipment, reflects the need for multiple cleaning of some classes of grain.

In addition, there is storage for 107 rail boxcars adjacent to the elevator supplemented by Canadian National Railway storage capacity for another 400 cars.

During the last 5 years, the cleaning arrangements have been greatly improved. Cleaning remains, however, the main potential bottleneck due mainly to the fact that most of the grain has to be cleaned two or three times to obtain the required standard.

Miscellaneous Facilities - The National Harbours Board has a well equipped machine shop, which is capable of carrying out emergency repairs to ships. These repairs are limited to work above the water line because there is no equipment for doing underwater work. Damage not too far below the waterline can, however, often be repaired by altering the trim of the vessel or causing it to list.

The Department of Public Works owns a tank farm on National Harbours Board property for storing and supplying fuel oil and gasoline.

Navigational aids are provided by the Department of Transport. These consist of an effective arrangement of leading marks and lighted buoys which are maintained by the National Harbours Board.

Commercial vessels entering and leaving the port are required

to use a pilot. The pilots are conveyed to or from the ships in the smaller of two tug boats provided by the National Harbours Board. In rough weather, the boarding of vessels by pilots outside the harbour can become hazardous and impractical. As a result some ships have to remain outside the harbour for periods which occasionally are as long as two or three days.

The National Harbours Board operates two diesel engined tugs of 1,520 and 250 h.p. These tugs are used to assist vessels in the turning basin adjacent to the wharf. Large vessels are usually turned before loading, but smaller vessels may be turned either before or after loading.

Conclusion

From the foregoing it is evident that the Port's past and present function has been and remains primarily one of serving western Canadian grain producers and grain buyers in the United Kingdom and Western Europe. It was for the purpose of devèloping an alternate route for grain exports that the Port of Churchill was established. Throughout its history the Port has not significantly deviated from this basic function by becoming more diverse in the commodities handled or regions served.

The grain and ship handling facilities at the Port are considered to be adequate to serve this function within the context of todays technology and the quantity of grain being shipped.

PART II

THE MARKET POTENTIAL FOR THE PORT OF CHURCHILL

CHAPTER 2

POTENTIAL COMMODITY TRAFFIC

Any assessment of potential inbound and outbound traffic through the Port of Churchill must be based upon an examination of: a) the future demand and supply for those commodities which can be shipped in and out of the Prairies at a transportation cost advantage by utilizing this Port compared to other ports and, b) the effect of technological developments on the future length of the navigation season. The remainder of this report consists of an evaluation of both of these factors and their probable effects through to the year 1985.

Outbound Exports

The identification of those specific commodities which potentially might be exported through the Port of Churchill was arrived at through consideration of production, consumption and the transportation cost advantage which might be gained by utilizing the Hudson Bay Route rather than alternative Canadian ports. For example, in estimating future offshore demands in export markets for commodities originating in the Churchill Hinterland in the Prairies, alternative non-Canadian sources of supply which may compete for these export markets were taken into account. Production in the Hinterland, export markets, competitive sources of supply and forwarding costs relative to other Canadian ports were considered for the following export commodities originating in the Churchill

Hinterland:

- Grain
- Forest products
- Base metals
- Petroleum
- Potash

Inbound Imports

In the case of products which can be imported through the Port of Churchill the potential was arrived at through the use of a three-stage analysis. The first stage dealt with the determination of the Churchill Hinterland; i.e. that geographic point of Canada over which the Port of Churchill has a transportation cost advantage compared to other major Canadian ports for inbound cargo shipped from specific foreign countries. The second stage consisted of an evaluation on the basis of an historical analysis, of the demand in the Churchill Hinterland, both at the present and in the future, for foreign goods and the relative importance of alternate existing transport routes in supplying this demand. The third stage consisted of the determination of possible changes in a number of factors which might affect future utilization of Churchill for imports. These factors include changes in the length of navigation season, transport technology and other variables. This three-stage analysis based on available information has provided an indication of the probable potential commodity import volume which may utilize the Port of

Churchill in the future.

Outbound and Inbound Coastal Shipping

The remaining area for which potential commodity volumes were identified, were the commodities shipped through the Port of Churchill, destined for Northern settlements, for the supply of the Port itself and for adjacent communities. Such commodities are carried largely in coastal shipping and in the past have not amounted to significant volumes when compared to total Port traffic. In order to project potential future volumes, assumptions concerning resource development in the Arctic area now supplied through the Port of Churchill were made. It was on the basis of these assumptions that the potential volume of coastal shipping through the Port was estimated.

The following chapters in Part II consider the market potential for the Port of Churchill to 1985 discussing in detail those market factors which will in the future affect potential Port traffic. This market potential analysis is based solely on demand and supply. It is predicated on the assumption that there are no technological or climatic barriers to the use of the Port -- i.e. it is assumed that the Port is open twelve months of the year and that facilities and ships are available to handle all of the products that would be shipped in and out of the Port on this basis.

The kind of analysis described in this part of the report serves to set an upper limit on the potential utilization of the Port.

The subsequent analysis of climate, navigation problems and future shipping techniques outlined in Part III of this report describes the technical limitations which will be experienced in reaching this goal.

CHAPTER 3

PRESENT GRAIN EXPORTS AND THE PORT OF CHURCHILL

Export Destination

The Port of Churchill is only one part of a transportation system which has been developed to transport grain from Western Canada to offshore export markets. Before the Port of Churchill's role in this grain transportation system can be determined it is first necessary to examine the various factors which affect grain exports, and the ports which are utilized in their export.

Export sales of western grains are made through the Canadian Wheat Board. The Board sells grain in two different ways. The bulk is handled by shippers and exporters acting as agents for the Board. A lesser amount is sold directly by the Board dealing with foreign governments or their appointed agents.

Most of the grain exported to Eastern and Western Europe is shipped through Atlantic and St. Lawrence ports, almost half of which goes to the United Kingdom. The major market area for grains going through the Port of Churchill is also Western Europe and particularly the United Kingdom. The prime export market supplied by terminal elevators located at Pacific ports is Asia but substantial amounts of grain and especially wheat, originating at these Pacific ports are sent to South America, Eastern Europe and Western Europe.

Importers of Canadian grain can obtain their purchases in two ways. The Canadian Wheat Board publishes asking prices for grain in store Fort William/Port Arthur, in store Vancouver and C.I.F. St. Lawrence ports. The buyer can purchase wheat or other grains directly from the Wheat Board at the asking price and can arrange for shipment to final destination through a broker. The cost to the buyer for transporting the grain to final destination is negotiated with the broker. The other way in which the purchaser may obtain the grain is by ordering through a broker and negotiating with the broker for a laid down price at final destination. In the latter cases, it is the broker who makes the direct purchase from the Wheat Board and undertakes the responsibility of transporting the grain from the Canadian terminal position to final destination.

Forwarding Costs

To a buyer of Canadian export grains the costs which are important are the in store prices quoted by the Board at specific ports and the additional costs which he would incur in transporting the purchase to its desination. The in store price at forward terminal positions as established by the Board is an adjusted price designed to ensure that the grain is generally competitive irrespective of the port of shipment. In arriving at the adjusted in store price the Board fully considers all forwarding and handling costs both inland and ocean.

The costs so considered are as follows:

1. Interior Handling Costs - includes elevator elevation, inward inspection, weighing and registration and selling charges.

2. Rail Freight - rail freight charges for grain movement from country points to forward terminal positions. These rates are governed by the Crowsnest Pass Agreement.

3. Lakehead Fobbing - includes terminal elevation, outward inspection, weighing and warehouse receipt cancellation and Lake Shippers' charges.

4. Terminal Diversion Cost - terminal diversion charges of 1.5¢ per bushel at Churchill only. The diversion charge is designed to compensate private elevator companies for storage and handling revenues they would have received had grain been shipped from their country elevators to their own forward terminals rather than to the publicly owned terminals at Churchill.

5. Lake Transportation Costs - includes lake freight, lake brokerage, lake insurance, rail freight and rail shrinkage (for maritime movement), bank charges and agent's commission.

6. Seaboard Fobbing - includes elevation (not charged at St. Lawrence ports), outward inspection and weighing not previously charged, warehouse receipt cancellation, Lake Shippers' charges (Lakehead only), superintendance (not charged at Pacific ports), cargo rates (Pacific ports only), wharfage (not charged at Lakehead), forwarding broker (St. Lawrence and Maritime ports) and bank charges (Churchill only).

7. Ocean Transportation Charges - includes ocean freight, ocean insurance, bank charges and interest charges.

The interior handling costs, rail freight charges and diversion charge are generally non-variable and largely determined by government agencies. On the other hand, lake transportation costs, seaboard fobbing and ocean transportation costs are generally variable and largely controlled by market factors external to government policy. Because of the combination of these individual cost items, total forwarding costs on wheat from Scott, Saskatchewan, a mid-prairie point in the Churchill Hinterland, to the United Kingdom are lower through the Hudson Bay route

via the Port of Churchill than the other grain export routes through eastern Canada and the Pacific coast (see Table 2).

In 1966/67 the savings in forwarding costs per bushel on wheat exports moving through Churchill to the United Kingdom from such a mid-prairie point were 6.03 cents over the Pacific ports, 11.32 cents over the St. Lawrence ports, 17.82 cents over the Maritime ports and 10.23 cents over the direct movement via the Lakehead. Over a five-year period average forwarding costs through Churchill were 3.36 cents less than through Pacific ports, 10.26 cents less than St. Lawrence ports, 19.75 cents less than Maritime ports and 9.71 cents less than direct exports from the Lakehead. The foregoing indicates that, at the present time, there is a significant forwarding cost advantage to be realized by utilizing the Port of Churchill for wheat exports to the United Kingdom. As larger ships are used for grain exports from ports having deeper harbours this advantage could conceivably be eroded substantially. If, either because of physical or economic reasons, it is found not feasible to dredge the harbour at Churchill to depths which would accommodate the larger ships, the historical cost advantage may be reduced.[1]

Although wheat is currently the only grain which is offered for export through Churchill, it is estimated on the basis of wheat forwarding costs that if other grains were to be exported through Churchill an advantage in forwarding costs could be gained (see Table 3).

Insurance Costs

The cost of insuring both hull and cargo are included in the total forwarding costs and are generally considered to be a

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[1]This problem is discussed in Chapter 14.

TABLE 2

ESTIMATED AVERAGE COST OF EXPORTING CANADIAN WHEAT TO THE UNITED KINGDOM FROM A MID-PRAIRIE POINT - 1966/67
(Cents per Bushel)

	Via Pacific Ports	Via Churchill	Via St. Lawrence	Via Maritimes	Lakehead Direct
Interior Handling Costs	4.50	4.50	4.50	4.50	4.50
Rail Freight	13.80	13.20	13.80	13.80	13.80
Diversion Charge	-	1.50	-	-	-
Lakehead Fobbing	-	-	3.81	3.37	-
Lake Transportation Costs	-	-	12.07	21.92	-
Seaboard Fobbing	4.54	4.75	.44	2.48	4.54
Average Ocean Charges[a]	30.45	23.31	23.96	19.01	34.65
Estimated Total Cost	53.29	47.26	58.58	65.08	57.49

Source: Board of Grain Commissioners For Canada.

Note: This table is based upon actual grain shipments and the costs experienced at the ports or port areas indicated. In the case of the St. Lawrence it includes all the upper and lower St. Lawrence ports. The specific handling costs per bushel vary significantly from the average depending upon the size of ocean vessel and the specific port utilized. For example, the differences in ocean charges on grain shipped via Montreal compared to Baie Comeau may vary as much as 20 to 25 per cent. The combination of shorter distance, the use of larger vessels from the latter port to the United Kingdom will result in substantially lower total charges than from the former port.

[a] Includes cargo and vessel insurance.

TABLE 3

ESTIMATED FORWARDING COSTS TO EXPORT
BARLEY, FLAXSEED AND RAPESEED
FROM A MID-PRAIRIE POINT
TO THE UNITED KINGDOM - 1966/67
(Cents per Bushel)

	Via Pacific Ports	Via Churchill	Via St. Lawrence	Via Maritimes	Lakehead Direct
Barley	42.63	37.81	46.86	52.07	45.99
Flaxseed	49.73	44.11	54.67	60.74	53.65
Rapeseed	44.40	39.39	48.81	54.24	47.90

Source: Estimates based on the average forwarding costs of wheat.

deterrant to utilizing the Churchill Route. Insurance on cargo is based upon the value of the cargo and rates charged for specific ocean movements are negotiated individually -- no schedule of rates is published. Information obtained from a number of firms in the grain trade indicates that the rate per $100 of cargo to the United Kingdom from Montreal is between 9 cents and 10 cents, the rate from Vancouver between 17 cents and 19 cents, and the rate from Churchill for most of the navigation season around 55 cents per $100 of cargo.

Based upon these indicated rates, the cost per bushel of wheat for cargo insurance on grain shipped to the United Kingdom would then be as follows:

Wheat moving to the U.K. from:	Estimated Cost of Cargo Insurance on Wheat
St. Lawrence	0.10 cents/bushel
Pacific ports	0.20 cents/bushel
Port of Churchill	0.55 cents/bushel

As can be seen from the above cost estimates, cargo insurance on wheat from Churchill though significantly higher than the St. Lawrence and Pacific ports is still only a fraction of a cent per bushel.

The approximate hull insurance cost of sending a ship to Churchill during the open season through Hudson Bay have been greatly reduced over the years since 1931 compared to other Canadian ports, and the current premiums on vessels amounts to about $1\frac{1}{2}$ cents to 2 cents per bushel, depending on the size of the vessel.[2]

It may be said, then, that the additional hull and cargo insurance costs on grain moving through Churchill represent about 4 per cent to 5 per cent of the total cost of forwarding grain from the Prairies to the United Kingdom. The cost disadvantage of higher ocean insurance of this magnitude is substantially out-weighed by the other forwarding cost advantages gained by using the Hudson Bay Route. It seems unlikely, therefore, that the additional cost of ocean insurance at current rates significantly influences the volume of grain traffic through the Port.

[2] Insurance on vessels using the Port of Churchill is discussed in Appendix E, Volume II.

The total forwarding costs which have been discussed and summarized in Table 2 include ocean insurance. The savings in total forwarding costs which can be realized by utilizing the Port of Churchill are of such a magnitude that it is not logical to argue that the higher cost of ocean insurance significantly influences the volume of grain traffic through the Port.

Comparative In Store Grain Prices

The Port of Churchill has in the past offered definite advantages to both the prairie wheat producer and buyers in the United Kingdom. In 1966-1967 the Wheat Board received a higher price for wheat purchased ex Churchill than at either Vancouver or the Lakehead as shown in the following:

In Store Position	No. 2 Northern - In Store Price Average 1961/62 - 1965/66	Average 1966/67
	$	$
Lakehead	1.952	2.088
Vancouver	2.016	2.133
Churchill	2.013	2.155

Source: Annual Reports of the Canadian Wheat Board.

The higher price received for wheat moving through the Port of Churchill is pooled with the proceeds from wheat sales through the Lakehead and Vancouver and then the total pooled account is distributed to the prairie wheat producers -- with all weatern wheat producers realizing the same price per bushel. The higher priced wheat moving through the Port therefore benefits

all prairie producers equally by increasing the amount of total sales revenue in the pooled wheat account but provides no specific benefits to those in the Churchill Hinterland.

The buyer in the United Kingdom benefits from utilizing the Port of Churchill because of the favourable market advantage which the Port offers relative to forwarding costs. Despite the higher price of wheat offered through Churchill, the lower forwarding costs from this in store position to the United Kingdom compared to those from the Lakehead and Vancouver means that the buyer can purchase wheat at Churchill and forward it to the United Kingdom at a lower total cost than from the Lakehead, Pacific ports, St. Lawrence ports and the Maritimes.

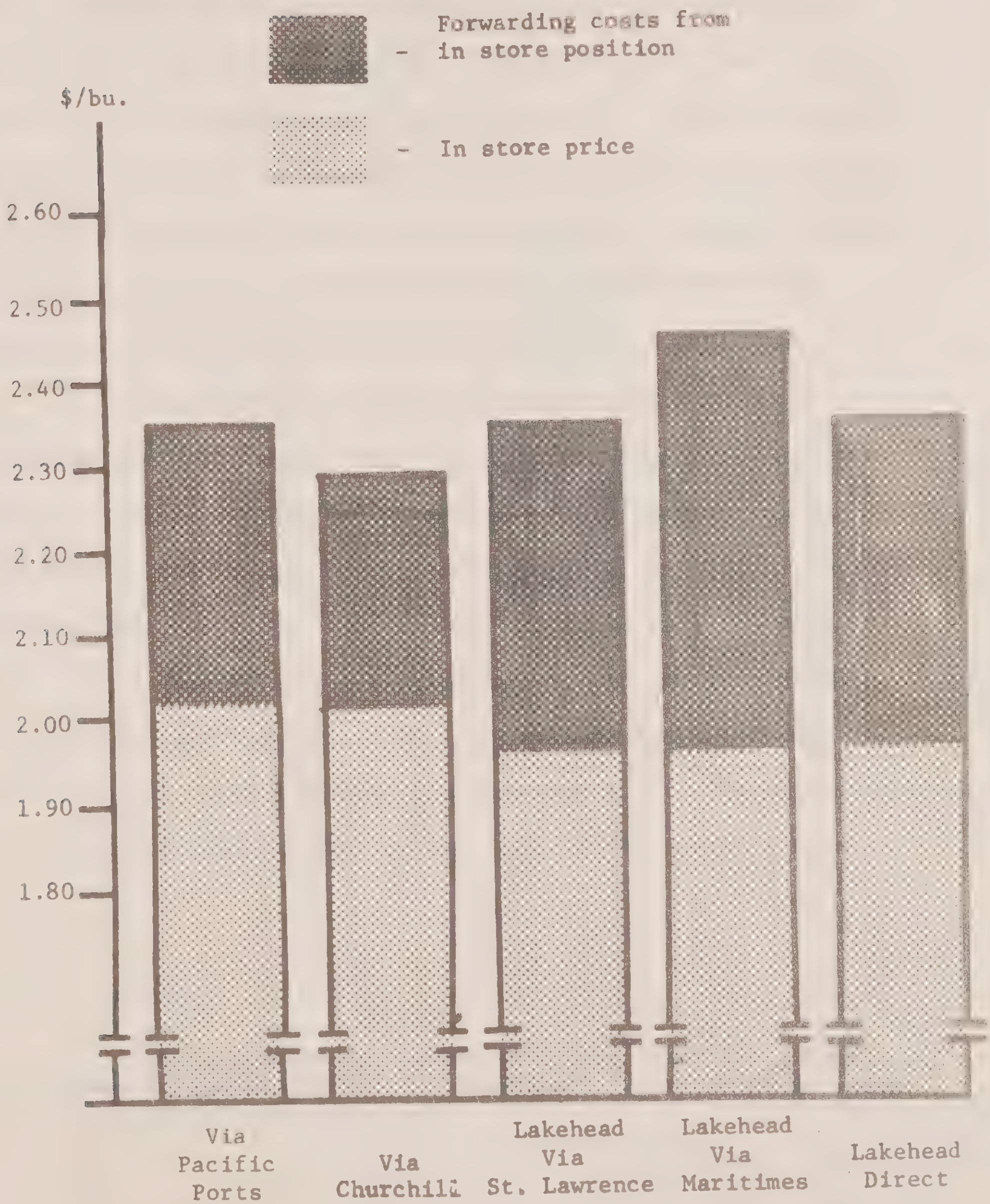
Figure 3 shows the comparative costs facing a buyer of Number 2 Northern for purchasing and forwarding a bushel through the different port areas to the United Kingdom.

Churchill Hinterland

The area within the prairie region or the Churchill Hinterland from which grain is exported through Churchill has no definite boundaries and in terms of geography is variable over time. Depending upon total forwarding costs, production and export demands, the outline of the Hinterland may change from one period of time to another. In order to project potential grain exports and considering that ocean forwarding costs through the projection period are unpredictable, only the inland transportation

FIGURE 3

TOTAL COST TO BUYER - IN STORE PRICE
AND FORWARDING COST FROM IN STORE POSITION
FIVE YEAR AVERAGE 1961/1962 - 1965/1966



costs have been used to establish the configuration of the Churchill Hinterland (see Figure 4).

The Churchill Hinterland is defined as that area from which grain shipments might logically be moved through the Port of Churchill either breaking even or gaining a rail rate advantage over Fort William/Port Arthur and Vancouver. In this area approximately 69 per cent of primary net receipts of grain is to country elevators located at delivery points situated on Canadian National Railway branchlines. The Hinterland has been defined on the basis of rail rates quoted by the Canadian National Railway.[3]

Since the rail line to the Port of Churchill is a Canadian National Railway line, the Canadian Pacific Railway does not quote rates to this Port. Hypothetically then, the grain received at the Canadian National Railway delivery points can be considered as potential exports which could be rail shipped to the Port of Churchill at a rate advantage or breaking even with the Lakehead and Vancouver. In practice some grain does move from Canadian Pacific Railway lines to Churchill. The public terminals located at Moose Jaw and Saskatoon on occasion receive

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[3] It is assumed for purposes of this study that future rail rates on grain destined for export will continue to be based on the Crowsnest Pass Agreement.

FIGURE 4

CHURCHILL HINTERLAND
GRAIN EXPORTS

grain from the Canadian Pacific Railway and switch the grain to the Canadian National Railway line to Churchill. The amount of grain which is shifted, however, in recent years at least, is not substantial. Therefore it is assumed that the potential grain exports through the Port of Churchill will continue to originate primarily at Canadian National Railway delivery points within the defined Hinterland.

Of the total country elevator receipts in the Churchill Hinterland in a recent ten-year period to 1956-1957 through 1965-1966, Canadian National Railway delivery points averaged 123.0 million bushels annually and the Canadian Pacific Railway delivery points 55.2 million bushels. Total primary net receipts in this area averaged 178.2 million bushels annually.

It is estimated that of total country elevator receipts within the Hinterland area, approximately 69 per cent are made to Canadian National Railway delivery points. Therefore, it has been assumed that potential grain exports through Churchill will in the projection period be based on receipts at Canadian National Railway delivery points and that these will continue to receive 69 per cent of producer deliveries in the Hinterland area.

CHAPTER 4

FUTURE GRAIN EXPORTS AND THE PORT OF CHURCHILL

Potential Wheat Exports - All Canada

In recent years wheat has been the only grain exported via the Port of Churchill (i.e. 1961/1962 through 1965/1966). During this period wheat exported from Churchill averaged 22 million bushels, accounting for approximately 5.3 per cent of total wheat exported overseas but only 4.7 per cent of total grains exported overseas (see Table 4).

TABLE 4

WHEAT: OVERSEAS CLEARANCES
(million bushels)

	Via Canadian Pacific Seaboard	Via Canadian St. Lawrence Ports	Via Canadian Atlantic Ports	Via Churchill	Via Lakehead Direct
1961-1962	180.9	129.0	21.8	19.2	15.1
1962-1963	160.3	120.5	20.2	21.8	21.8
1963-1964	220.7	288.6	54.5	21.7	17.5
1964-1965	186.1	156.5	34.3	22.1	21.7
1965-1966	234.7	301.6	40.2	25.1	25.9
5 Year Average	196.5	199.2	34.2	22.0	20.4

Source: Board of Grain Commissioners for Canada.

The projected volumes of wheat which might potentially move through the Port of Churchill in the future must in large part

be based upon external factors determining the world wheat market and the way in which this external market will affect domestic production. Therefore before potential wheat exports which might move through the Port of Churchill can be arrived at it is first necessary to consider future world demand for Canadian wheat and the offshore areas which will exert this demand.

Future Canadian wheat exports face a wide range of prospects. Optimistic prospects are that new markets for Canadian wheat will emerge and that existing markets will remain firm in the future despite the present slump. Less optimistic prospects are that the recent decline in exports is indicative for the long term period and that there will not be substantial increases in exports. The following table provides wheat export projections based on both the optimistic assumptions (Model A) and less optimistic assumptions (Model B) as described above.

TABLE 5

PROJECTED CANADIAN WHEAT EXPORTS
(million bushels)

	Model A	Model B
1970	525	450
1975	550	455
1980	570	470
1985	600	485

Source: Hedlin, Menzies & Associates Ltd.

Potential Wheat Exports - Churchill Hinterland

Future wheat exports from the Hinterland area will depend in part on the future product mix of the area. This mix might change if feed grain production and its export became economically more attractive. The Hinterland area for the most part lies in the northern half of the Saskatchewan agricultural belt, an area which is basically more amenable to barley production than wheat. For this reason, it is possible that if exports of feed grain were to be expanded substantially, barley acreage might be increased at the expense of wheat acreage. In view of the range of prospects which face the grain producer in the Churchill Hinterland, it is extremely difficult to guage precisely the extent to which acreage might be reallocated and to what extent the product mix could change. Therefore, it has been assumed that both producer deliveries to country elevators in the Hinterland and exports of wheat originating in the Hinterland will continue in the same relative proportion to total Canadian exports as existed in the base period 1956/1957 through 1965/1966 as shown in Table 6.

From the application of the principles of the continuation of past proportionate exports from the Churchill Hinterland, as described in Table 6, applied to the total projected Canadian wheat exports, as shown in Table 5, it is possible to arrive at an upper and lower range of potential wheat exports from the Churchill Hinterland to 1985. This projection of possible wheat exports is shown in Table 7.

TABLE 6

WHEAT EXPORTS - PRAIRIE REGION
C.N.R. DELIVERY POINTS IN CHURCHILL HINTERLAND
(TEN YEAR AVERAGE 1956/1957 - 1965/1966)

Prairie Region	
Primary net receipts	428.7 (million bushels)
Total Canadian exports	337.4 (million bushels)
Exports as a per cent of receipts	78.7 (per cent)
Churchill Hinterland	
Estimated primary net receipts	94.4 (million bushels)
Estimated exports at 78.7 per cent of receipts	74.3 (million bushels)
Per cent Hinterland exports to Total Canadian exports	22.0 (per cent)

Source: Dominion Bureau of Statistics, Catalogue No. 22-201, Grain Trade of Canada. Hedlin Menzies & Associates Ltd.

TABLE 7

PROJECTED WHEAT EXPORTS FROM C.N.R.
DELIVERY POINTS IN THE CHURCHILL HINTERLAND
(million bushels)

	Model A	Model B
1970	115.5	99.0
1975	121.0	100.0
1980	125.4	103.4
1985	132.0	106.7

Source: Hedlin, Menzies & Associates Ltd.

Potential Wheat Exports - Port of Churchill

Of the projected wheat exports from Canadian National Railway delivery points in the Hinterland shown in Table 7, not all

could be considered as potential exports which might logically move through the Port of Churchill. In the past wheat which has been exported through the Port of Churchill has been mainly Number 2 Northern. This grade has been the major grade desired by the traditional European markets as a milling input to supplement their domestic soft varieties. If it is assumed that only the higher grades of wheat will continue to be purchased through the Port, then on the basis of grades produced in the Hinterland in the past, that portion of total wheat exports originating in the Hinterland which could be considered as potential traffic would amount to approximately 40 per cent of the total.[1]

The potential of 40 per cent would be applicable to Model A, which assumes that quality will remain an important factor in wheat production. Model B assumes that higher yields will become more important than quality in the future. Therefore, under Model B, the potential of the Hinterland to export wheat through Churchill would probably be reduced even further to perhaps 35 per cent of wheat exports from the area as shown in Table 8.

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[1] The estimate of grades produced in the Hinterland is based on information obtained from the Board of Grain Commissioners for Canada.

TABLE 8

POTENTIAL WHEAT EXPORTS THROUGH
THE PORT OF CHURCHILL
(million bushels)

	Model A	Model B
1970	46.2	34.7
1975	48.4	35.0
1980	50.2	36.2
1985	52.8	37.3

Source: Hedlin, Menzies & Associates Ltd.

The potential wheat exports indicated in the above table have been arrived at through consideration of the production capacity of the Hinterland area in relation to expected export demands. Before finally determining the actual magnitude of wheat exports which may realistically be expected to move through the Port of Churchill in the future, consideration must be given to the length of the navigation season, other commodity traffic, adequacy of the Port facilities and the willingness of buyers to purchase grain ex Churchill.

Potential Feed Grain and Oilseed Exports - All Canada

Potential offshore exports of feed grains and oilseeds from the Churchill Hinterland, as with wheat, depend upon future production, domestic consumption, future export market demands and the competitiveness of Canadian grains in the export markets. In order to develop an estimate of the potential of the Hinterland for exporting feed grains

and oilseeds a number of assumptions were made in regard to both future export markets and production on the prairies.

In the post war era meat consumption in the United Kingdom and Western Europe has increased tremendously. This has demanded ever increasing feed grain inputs adding to the considerable pressures on available agricultural land. Increasing feed grain consumption is expected to continue through 1985. Though Western Europe has been able to substantially increase domestic production of feed grains, a deficit in domestic supply remains. Increasing imports of feed grains have been required to supplement domestic production and it is expected that even larger volumes of feed grain imports will be required to 1985.

Oilseeds are now imported by the United Kingdom and Western Europe but the quantities in comparison to wheat and feed grains are rather small. It is expected that Western Europe will continue to import oilseeds for both human consumption and industrial consumption.

As in the case of wheat, two projections have been made for feed grains with each projection incorporating a different set of assumptions. The first projection or Model A views prospects for future feed grain exports as favourable, the second projection or Model B views prospects for future feed grain exports in a less favourable light.

Model A projects barley exports on the assumption that under proper management and application of fertilizers and herbicides, yields can be increased substantially thus reducing the cost and subsequently price. Priced reasonably and produced in sufficient quantity, overseas

exports of barley could well be expected to increase substantially. Model A assumes that the conditions will be met in the projection period to allow Canada to effectively compete for a larger share of the feed grain export market.

Model B assumes that barley will not be produced at a cost which will allow Canadian barley to effectively compete for feed grain export markets with United States feed grains. Model B projects barley exports to decline to a level of 30 million bushels annually by 1970 and remain at this level throughout the projection period. The potential volume of exports to 1985 under both sets of assumptions is shown in Table 9.

TABLE 9

PROJECTED OVERSEAS EXPORTS OF CANADIAN FEED GRAINS
(million bushels)

	Model A	Model B
1970	75	30
1975	100	30
1980	125	30
1985	150	30

Source: Hedlin, Menzies & Associates Ltd.

In the case of oilseeds, the potential export volumes are considerably smaller and the future outlook of both demand and supply does not lend itself to meaningful minimum and maximum projections. Consequently, although separate projections have been made for the two principal oilseeds, rape and flax, the Model A and B projections

have been combined.

If present production trends continue and marketing efforts remain unchanged, rapeseed exports to Europe are expected to decline slightly during the projection period. Trends in Asia, on the other hand, indicate that this market will appreciably expand during the projection period. Therefore, a steady increase has been forecast in exports from 1970 through 1985 since future increases in Asia are estimated to more than offset the expected decrease in Europe.

Similarly, it is expected that flaxseed exports to Europe will decrease slightly, but as in the case of rapeseed, trends indicate that exports to Asia will increase sufficiently to offset any decrease in Europe. Therefore, it is projected that total flaxseed exports will increase steadily from 1970 through 1985 as shown in Table 10.

TABLE 10

PROJECTED OVERSEAS EXPORTS OF CANADIAN OILSEEDS
(million bushels)

	Model A and Model B		
	Rapeseed	Flaxseed	Total
1970	19.0	15.5	34.5
1975	24.0	16.5	40.5
1980	29.0	17.0	46.0
1985	34.0	17.0	51.0

Source: Hedlin, Menzies & Associates Ltd.

Potential Feed Grain and Oilseed Exports - Churchill Hinterland

In order to estimate potential exports of feed grains and oilseeds from the Hinterland, it was assumed that producer deliveries of these grains and their export will continue to be in the same proportions relative to total primary net receipts in the prairies and total exports as existed in the past (see Table 11).

TABLE 11

FEED GRAIN AND OILSEED EXPORTS - PRAIRIE REGION
C.N.R. DELIVERY POINTS IN
CHURCHILL HINTERLAND
(10 Year Average 1956/1957 - 1965/1966)

Prairie Region	Barley	Flaxseed	Rapeseed
Primary net receipts (million bushels)	94.0	17.3	17.3
Total Canadian Exports (million bushels)	35.7	14.7	13.7
Exports as a per cent of receipts	38.0	85.0	79.2
Churchill Hinterland			
Estimated primary net receipts (million bushels)	17.3	2.2	2.9
Estimated Exports (million bushels)	6.6	1.8	2.3
Per cent Hinterland Exports to Total Canadian Exports	18.5	12.9	23.0

Source: Dominion Bureau of Statistics, Catalogue No. 22-201, Grain Trade of Canada. Hedlin, Menzies & Associates Ltd.

By estimating the receipts of barley, flaxseed and rapeseed in recent years in the Hinterland and assuming that exports of these grains originating at C.N.R. delivery points in the Hinterland would bear the same relationship to total prairie receipts, exports from the Hinterland

were estimated. It was also assumed that throughout the forecast period exports from the Canadian National Railway delivery points will continue to represent 18.5 per cent, 12.9 per cent and 25.0 per cent[2] respectively of total exports barley, flaxseed and rapeseed. On this basis, projections for the Hinterland were developed using both Model A assumptions and Model B assumptions as shown in Table 12.

TABLE 12

PROJECTED FEED GRAIN AND OILSEED EXPORTS FROM C.N.R. DELIVERY POINTS IN THE CHURCHILL HINTERLAND (million bushels)

	Model A and Model B					
	Barley		Flaxseed		Rapeseed	
	A	B	A	B	A	B
1970	13.9	5.6	2.0	2.0	4.7	4.7
1975	18.5	5.6	2.1	2.1	6.0	6.0
1980	23.1	5.6	2.2	2.2	7.2	7.2
1985	27.8	5.6	2.2	2.2	8.5	8.5

Source: Hedlin, Menzies & Associates Ltd.

Potential Feed Grain and Oilseed Exports - Port of Churchill

Despite the fact that to date the only grain exported offshore through Churchill has been wheat, it is considered that there is an export potential for other grains. Barley could potentially be

[2] Rapeseed exports from the Hinterland are expected to increase in significance relative to total prairie rapeseed exports.

exported through the Port of Churchill to Western Europe with a rail rate advantage. On the basis of projected Canadian feed grain exports to Europe, a portion of the projected barley exports from the Hinterland might potentially move through the Port of Churchill. A portion of the projected flaxseed exports from the Canadian National Railway delivery points could also, logically move through the Port of Churchill. Projections of rapeseed exports and the location of export markets indicate that less than half the projected exports from the Canadian National Railway delivery points could be considered as potential exports for the Port of Churchill. Rapeseed exports to Europe are expected to decline slightly throughout the projection period while exports to Asia are projected to increase steadily.

On the basis of this evaluation it is assumed that by 1985 there is a potential for the export of between 9.8 and 32.0 million bushels of feed grains and oilseeds through the Port of Churchill as shown in Table 13.

TABLE 13

POTENTIAL FEED GRAIN AND OILSEED
EXPORTS THROUGH THE PORT OF CHURCHILL
(million bushels)

	Model A	Model B
1970	17.9	9.6
1975	22.6	9.7
1980	27.3	9.8
1985	32.0	9.8

Source: Hedlin, Menzies & Associates Ltd.

The potential traffic for the Port of Churchill shown in the above table assumes that there are no restrictions in the ability to store and handle the grains at the Canadian National Railway delivery points, and that the timing and scheduling of the exports through the Port will not be limited because of capacity to handle the grain volumes. In addition, it has been assumed that buyers will not be reluctant to order grain from the Port of Churchill.

Total Potential Grain Exports - Port of Churchill

Based upon the foregoing evaluation, it is considered that if the Port of Churchill's projected potential for grain exports were to be fully realized, by 1985 the Port could be utilized for between 8.3 and 10.6 per cent of Canada's total grain exports or between 47.1 and 84.8 million bushels (see Table 14).

TABLE 14

POTENTIAL GRAIN AND OILSEED EXPORT
THROUGH THE PORT OF CHURCHILL
(million bushels)

	Model A	Model B
1970	64.1	44.3
1975	71.0	44.7
1980	77.5	46.0
1985	84.8	47.1

Source: Hedlin, Menzies & Associates Ltd.

Note: It is unlikely that the maximum potential for both grain and oilseeds exports shown in Model A could be simultaneously produced in one season in the Churchill Hinterland. The most probable potential would lie between Model A and Model B.

It is stressed, however, that the potential forecast grain exports through the Port are a target based upon supply, demand and inland rail transport costs. It does not take into account the length of the navigation season, the facilities at the Port, any problems of navigation and perhaps most important the willingness of grain buyers in export markets to purchase grain ex Churchill. All of these factors will reduce the potential, to a greater or lesser extent.

For example, in the past the Canadian Wheat Board has encouraged the utilization of the Port of Churchill by moving into position at Churchill grades of wheat which are preferred in the market area nearest to Churchill (Western Europe and the United Kingdom). Also, the in store price quoted for Churchill is established at a level designed to encourage buyers to purchase ex Churchill. Even with these forms of encouragement, the maximum volume of wheat exported in any one season has been approximately 25 million bushels.

Historically, grain exports from Churchill have failed to reach potential levels because of a variety of factors. Ship arrivals have been irregular, creating scheduling problems for Port facilities. In addition, present work practices, especially as regards cleaning operations, would be inappropriate for larger volumes. However, the prevailing major problem has been a reluctance on the part of buyers to order greater volumes of grain exports from Churchill.

The following Table 15 provides estimates of projected export volumes which could be moved through the Port assuming four different lengths of shipping season with Churchill's terminal and port facilities remaining unchanged.

TABLE 15

ESTIMATED CAPACITY POTENTIAL FOR GRAIN EXPORTS BASED ON PRESENT PORT FACILITIES
(million bushels)

Assumed Length of Port Operating Season	Estimated Export Capacity
82 days	30.0
123 days	40.0
213 days	70.0
365 days	120.0

Source: Hedlin, Menzies & Associates Ltd.

Note: The highest volume of grain exports from Churchill was approximately 25 million bushels in 1966-1967.

Even if the Port facilities were to be expanded to allow the total projected exports to be put through Churchill during the present season, it is very doubtful that buyers would purchase all the grain offered ex Churchill in such a short period of time. The most logical market for grain shipments from Churchill has been, and will continue to be, the United Kingdom and Western Europe. In recent years wheat has been the only grain exported through the Port and over 95 per cent of it has been purchased by millers in the United Kingdom and Western Europe. Millers like other businessmen do not like to carry unnecessarily high inventories but instead prefer to carry minimum inventories with a high rate of turnover. Because of the short season the Port of Churchill is unattractive to

millers who desire a steady source of supply which is accessible throughout the year and will remain so unless the season is lengthened.

From time to time countries in Eastern Europe are likely to demand large quantities of grain as they have in the past. The timing of these demands and volumes demanded have for the most part been dependent upon the domestic supply in Eastern Europe. In recent years only a small amount of wheat has been exported through Churchill to Eastern Europe and there is almost no possibility that this pattern will change. Therefore, any plans which are discussed for expanding the volume of grain exported through Churchill must be cognizant of the most logical market for the increased exports and the nature of the demand which this market exerts.

CHAPTER 5

FOREST PRODUCTS

The Forest Resource Base in Manitoba and Saskatchewan

The Port of Churchill has long been considered a potential gateway for the export of pulpwood and other products of the northern forests. This possibility rests on the fact that large tracts of accessible timber in the north of Manitoba and Saskatchewan have gone unharvested. This chapter consists of a discussion of the economic potential of these forests in relation to Churchill.

Productive forests cover 27 per cent of the land area in Manitoba and about 20 per cent in Saskatchewan. Their combined total of productive forest land is 100 thousand square miles, and in terms of timber available for future expansion, these two provinces compare very well with other areas of Canada. The data in Table 16 summarize the volume data for softwood and hardwood species. Table 16 indicates that Manitoba and Saskatchewan together contain nearly one-third as much softwood as Ontario and as the softwood species are clearly more desirable from the standpoint of costs and potential shipments through Churchill, at least over the forecast period, further discussion will exclude the hardwoods.

TABLE 16

ESTIMATED MERCHANTABLE TIMBER
MANITOBA, SASKATCHEWAN AND ONTARIO[a]
(million cubic feet)

	Manitoba	Saskatchewan	Ontario
Softwood			
Large Material	1,863	1,742	21,584
Small Material	7,862	8,725	45,070
Total	9,725	10,467	66,654
Hardwood			
Large Material	1,065	3,174	25,466
Small Material	2,056	6,530	19,450
Total	3,121	9,704	44,916

[a]Based on limited reconnaissance and not detailed forest inventories.
- Large Material 10" D.B.H. and over.
- Small Material 4-9" D.B.H.

A breakdown of the softwoods for Manitoba is as follows:

	Per Cent
Black Spruce	56
Jack Pine	21
White Spruce	18
Balsam Fir	4
Other	1
	100

Black spruce and jack pine are the favoured species for pulp and paper. In Manitoba these occur primarily in the Nelson River Clay Belt, in the Northern Coniferous Zone, and to a lesser extent in the Manitoba Lowlands to the west and north of Lake

Winnipeg. There is no commercial timber to speak of above a line running from Reindeer Lake in the northwest, through Gillam on the Hudson Bay Railway and then southeast to the Ontario Border.

In Saskatchewan the same softwood species predominate, and the commercial forest runs in a diagonal band across the middle third of the province. The southern limit runs from a point slightly below Hudson Bay Junction northwest through Prince Albert and Meadow Lake.

Foreseeable Pattern of Expansion

In spite of the fact that high quality wood exists in this volume, less than a fifth of the calculated annual allowable cut has been harvested annually in either province. Nevertheless, real progress in closing the gap is anticipated between now and 1985. The Abitibi newsprint mill at Pine Falls, the only large mill operating in Manitoba now, is scheduled to be joined by a kraft pulp mill at The Pas by 1971. This venture by Churchill Forest Industries is based on a timber allocation covering 40,000 square miles. It extends a considerable distance north and south of The Pas, east to Lake Winnipeg and northeast along the railway to Arnot. Initial pulp capacity will require approximately half of the estimated nonutilized reserves of Manitoba's softwood timber which is considered accessible, thus leaving substantial room for expansion and possibly some export of pulpwood as well. It is estimated that Manitoba presently has a surplus of

approximately 70 million cubic feet of softwood annually, which is enough to support two 600 ton per day kraft pulp mills in perpetuity. The best of this is included in the rights which have been allocated to Churchill Forest Industries.

The Parsons & Whittemore pulp mill which has recently been opened at Prince Albert is Saskatchewan's first. In addition, a feasibility study has been conducted at a second site near the Alberta border and other pulpwood limits are being examined near Hudson Bay Junction on the Manitoba side.

Softwood lumber production similarly is expected to expand in the future. A sawmill is now under construction by Churchill Forest Industries at The Pas. Its capacity by late 1969 will be 15 million board feet, with the possibility of doubling later. Integration of lumber and pulp industries should develop rapidly in both provinces and one or two small plywood plants are also likely.

It is reasonable to assume that the presently accessible forests will be largely occupied by 1985, in both provinces. But, with improved road and rail access, better forest management, and higher levels of utilization or recovery from a given acre, there should be room for expansion even after that date.

The timber is available, the expansion pattern has been identified, and the question is whether the Port of Churchill will be used in the distribution of forest products from these areas.

Pulpwood Export Potential

The rapidly increasing consumption of paper products is driving up the demand for pulpwood around the world. According to the FAO, pulpwood use is growing on a trend line exceeding five per cent annually. The resulting pressure on timber supply is associated with increasing international trade in pulpwood, especially in softwood species. While the broader world picture is of some interest, it is of less concern to the Port of Churchill than the situation in Western Europe, since it is not conceivable that pulpwood from Manitoba could be delivered via Churchill on a competitive basis either on the east coast of North America or in other Atlantic rim countries.

During the period 1949-1951 Europe's pulpwood trade was roughly in balance, with imports equalling exports. By 1959-1961 a deficit of 1.86 million cubic metres (approximately .75 million cords) had developed. By 1965-1967 the European deficit was averaging nearly 5 million cubic metres annually, with Canada and Russia supplying the greater part of it.

A more detailed look at exports from Canada to Western Europe shows that total shipments have fluctuated widely since 1951 (see Table 17). The 1952 peak of 355 thousand cords was not achieved again for ten years, falling in the interval to as low as 119 thousand cords. Another record was set in 1965 at 516 thousand cords, but in the two succeeding years this amount

TABLE 17

PULPWOOD EXPORTS TO WESTERN EUROPE FROM CANADA
(thousand cords)

1951	266	1960	149
1952	355	1961	275
1953	161	1962	360
1954	203	1963	292
1955	268	1964	453
1956	250	1965	516
1957	258	1966	427
1958	152	1967	259
1959	119		

Source: Dominion Bureau of Statistics.

was cut in half.

It is clear from this evidence that the European trade is characterized by marked instability, due to various influences such as weather, inventory policy, operating rates in the pulp and paper mills, and special conditions in supplying countries. This instability is reflected in pulpwood prices.

However, the erratic nature of the pulpwood trade does not negate the possibility of increased Canadian shipments to Europe. Manitoba's ability to share in this trade will depend on the relative level of her delivered costs. Cost estimates are shown in Table 18, and these are applicable to pulpwood from the Nelson River timber lands adjacent to Arnot, a central delivery point for the Port of Churchill.

The estimates given in Table 18 are based on current

TABLE 18

DELIVERED PULPWOOD COSTS C.I.F. EUROPEAN PORT

		Cost Per Cord
Wood cost: at roadside		
or in water, 50 - 100,000 cords annually	$	16.00
Towing, hauling		3.00
Debarking		3.00
Loading, overhead		2.00
Cost of wood: F.O.B. rail at Arnot	$	24.00
Rail freight: 15¢ per 100#, 3,300# per cord		5.00
Unloading, reclaiming from stockpile		1.00
Loading on vessel		3.50
Port charges, overhead		1.50
Cost of wood: aboard vessel at Churchill	$	35.00
Ocean Freight		20.00
Delivered cost	$	55.00

Source: Hedlin, Menzies & Associates Ltd.

forest industry operating costs and on a number of feasibility studies dealing with development of the Manitoba forest resource. The cost of delivering pulpwood to a debarking plant at Arnot is shown at $19.00 per rough cord, a figure justified by recent experience in Saskatchewan and Manitoba. The delivered cost of wood to the pulp mill at Prince Albert is now running at approximately $22.50 per cord. Rail and cargo freight rates have been estimated based on experiences in other areas and those given here are within the accepted pattern. The absence of actual traffic of this kind to date means that experience with rates has yet to be developed.

Average prices of pulpwood exports to three typical European destinations are shown in Table 19. These prices refer to "Pulpwood Balsam Fir Spruce Peeled", F.O.B. point of consignment. The relevant estimated cost for Arnot pulpwood is $35.00 per cord, loaded on a vessel at Churchill, plus an allowance for profit. On this basis alone, neither France nor Italy would have been competitive since 1961 and the United Kingdom only in a short part of the time. The added handicap of higher ocean freight from Churchill further worsens the Manitoba shipper's position relative to alternative sources in Eastern Canada.

The above is not conclusive proof that pulpwood cannot be exported to Europe at a profit, since neither the trade data nor the schedule of wood costs from Arnot are precise. For example,

TABLE 19

AVERAGE PRICE OF EXPORTS OF PULPWOOD FROM CANADA TO THE UNITED KINGDOM, FRANCE AND ITALY
(dollars per cord)

	United Kingdom	France	Italy
1961	$ 37.30	$ 32.70	$ 29.70
1962	39.40	30.70	29.10
1963	37.70	30.30	28.40
1964	33.70	29.10	29.50
1965	34.70	34.60	33.90
1966	35.30	30.80	30.80
1967	35.50	34.10	31.10
1968 - 6 months	35.00	32.90	29.90
Range	$ 33.70 - 39.40	$ 29.10 - 34.60	$ 28.40 - 33.90

Source: Dominion Bureau of Statistics, Trade of Canada.

the data does not allow a comparison of fibre quality and recovery, or species mix, from the two sources. The available evidence does suggest, however, that shipments from northern Manitoba are at a disadvantage relative to eastern Canada in terms of a) cost of wood loaded on vessels, b) ocean freight rates and c) flexibility in delivery schedules. In spite of this, in a given market situation in the future a short term contract may be quite possible,

however, there is little likelihood of a long term contract in the volume range necessary to achieve economies of scale. For these reasons it is not considered that there is any economic justification for installing pulpwood handling facilities at Churchill unless actual contracts are obtained. In this context it is also noted that there is mounting political resistance in Canada to the export of unprocessed wood, even from one province to another.

The question has been raised whether the export of pulpwood chips might be anticipated during the forecast period. It is not believed that the available volume would justify the necessary investment. A large volume of chips is now moving from the west coast of the United States to Japan in a fleet of specially designed chip carriers, shuttling between ports with handling facilities built for minimum costs per unit. This cannot be duplicated between Churchill and Europe.

Pulp and Paper Export Potential

Shipment of newsprint from the mill at Pine Falls in southeast Manitoba is out of the question as far as Churchill is concerned. The mill now planned for The Pas is scheduled for completion in 1971 at 500 tons per day of bleached kraft pulp. The timber allocated to this mill, or available from outside the licence area, is adequate for about twice the initial capacity. It can be presumed that pulp markets will justify at least 1,000 tons per day (345,000 tons per year) by 1985. Present planning by

the Manitoba Department of Mines and Natural Resources does not include a second pulp mill in the north.

There is no evidence that firm plans have been made regarding the long term destination of wood pulp from The Pas. Some indication can be assumed, however, from the ownership of Churchill Forest Industries. The three shareholders are: Monoca A.G. of Switzerland, G. Haindl'sche Papierfabriken of Germany, and Technopulp Inc. of the United States. As a general rule, investment capital from other countries has come to the pulp and paper sector in Canada to obtain an assured source of supply. In this instance it is assumed that some of the output will therefore go to Western Europe, and that these shipments will be made through Churchill as the open season permits. However, the main bulk of output will probably be into the United States midwest and eastern rail markets.

The Parsons & Whittemore bleached kraft pulp mill at Prince Albert has a rated capacity of 500 tons per day or 170,000 tons per year. The output is destined primarily for the United States midwest and east coast markets. A second pulp mill site on the west side of Saskatchewan is now under active consideration and a third site exists in the region near Hudson Bay Junction. The sources from which development capital comes will determine in part where the output will be sold. Rail mileage to Churchill from Hudson Bay Junction is 600 miles, compared with 760 from

Prince Albert and 510 from The Pas. All three can be considered within acceptable rail distance from Churchill.

The manufacture of kraft paper or newsprint is mentioned from time to time in connection with these pulp mill operations in northern Manitoba and Saskatchewan. For the purposes of this study it is not important to differentiate between these various products. The total tonnages shown can be considered either as all pulp or a combination of pulp and paper.

In summary, pulp and paper production in northern Manitoba and Saskatchewan will probably range from 600 to 800 thousand tons by 1985. At this time one can only speculate on the volume which might be shipped through Churchill. It would probably be no more than 50 to 100 thousand tons annually, given a significantly extended shipping season.

Lumber Export Potential

The shipment of lumber through Churchill is unlikely and should not be considered as a potential commodity which will be shipped in volume. The reason is simply that Manitoba is in a softwood lumber deficit position by a wide margin. This province consumes between 150 and 200 million board feet a year and produces only about 40 million. Unlike the other major forest products discussed above, Manitoba lumber producers have a substantial captive market which they would satisfy entirely by themselves if they were able. Moreover, the timber nearest

Churchill, north and east of The Pas and Flin Flon, is best suited for pulpwood.

The same situation is true in Saskatchewan. Nearby prairie markets are much more attractive than those in Western Europe. Some lumber does go to the United States rail market, but export overseas can be ruled out.

Potential Exports Through Churchill

The foregoing indicates that by 1985 a maximum of 50 to 100 thousand tons of pulp and/or paper might flow annually through the Port of Churchill from its Hinterland, but only if a substantially longer season existed and new port handling facilities were installed. Even under these conditions pulpwood shipments through Churchill will be by exception and do not constitute a potentially large and stable item for planning purposes.

CHAPTER 6

MINERAL PRODUCTS

The Mineral Resource Base in Manitoba and Saskatchewan

The potential shipment of mineral commodities through the Port of Churchill has been regarded as favourable in the past but somehow the promise has not been fulfilled. The purpose of this chapter is to reassess the potential in the light of current knowledge concerning the location of mineral resources, the anticipated pattern of development, the location of markets and costs.

Mineral production in Canada grew from $500 million to $4,000 million in the 20 years following World War II. Manitoba and Saskatchewan shared in this growth and actually bettered the national rate of increase doing so, however, with the help of petroleum and potash.[1]

For purposes of this analysis attention can be narrowed to three metallic minerals, namely nickel, copper and zinc and to sulphur which is produced in Alberta. These are the items which are produced for export in sufficient quantity in the Churchill Hinterland to

[1]The prospects for exporting petroleum from the Prairies through Churchill is discussed in Chapter 7. The prospects for potash exports is referred to on page 66 and discussed fully in Appendix G.

warrant examination in relation to the Port of Churchill. Base metals will be covered first.

Value and tonnage of the important base metals produced in Manitoba and Saskatchewan is compared with the rest of Canada in Table 20.

TABLE 20

OUTPUT OF NICKEL, COPPER AND ZINC
SASKATCHEWAN, MANITOBA AND OTHER CANADA
(Thousand Tons)

		Saskatchewan	Manitoba	Other Canada
1966	Nickel	-	57.8	165.8
	Copper	19.6	31.3	455.2
	Zinc	28.9	35.0	900.2
		48.5	124.1	1,521.2
1967	Nickel	.2	55.5	194.5
	Copper	22.7	29.5	540.1
	Zinc	30.2	35.6	1,018.7
		53.1	120.6	1,753.3

Source: Dominion Bureau of Statistics.

This volume data has been reported by Dominion Bureau of Statistics in the form of equivalent weight of refined metal even though much of it is marketed in the form of concentrates. But in proceeding to the specific situation in Manitoba and Saskatchewan we see that refined metal dominates shipments from both Thompson

and Flin Flon. The Lynn Lake operation does ship concentrates but these are dispatched to domestic smelters at present.

At the present time there are just these three large volume producers in the Churchill Hinterland. The International Nickel operations at Thompson currently produce about 50,000 tons of nickel annually. This is shipped exclusively as refined metal ready for the market. In addition to the refined nickel, in excess of 25,000 tons of cobalt oxide, elemental sulphur and a copper residue were also shipped from Thompson in 1967. Most of the shipments were by rail via Winnipeg. However, some 4,000 tons were shipped to the United Kingdom via Churchill and approximately 6,000 tons were destined for export via east coast ports. Thus, approximately 65,000 tons were sold in North American markets and 10,000 tons offshore. Shipments through Churchill have been erratic in recent years, failing to reach 1,000 tons in 1965 and 1966. A peak of 14,000 tons was achieved in 1962.

The Hudson Bay Mining and Smelting Company at Flin Flon produced approximately 70,000 tons of slab zinc and 35 to 40,000 tons of blister copper in 1967. The destination of shipments is not available in detail but it is understood that little or none of this was shipped through the Port of Churchill. Furthermore, the portion which was exported directly from Flin Flon to countries other than the United States was minor.

The Sherritt Gordon mine at Lynn Lake produces nickel and

copper concentrates which are refined at both Fort Saskatchewan and Flin Flon. Over one million tons of ore is mined from which over 100 thousand tons of concentrate ore is produced and rail shipped to Fort Saskatchewan and Flin Flon where the concentrate is refined to about 20,000 tons of metal.

Other smaller producing mines have been opened recently in northern Saskatchewan, at Waden Bay and Hanson Lake. It is reported that some of the concentrates will be milled at Flin Flon and that some will be exported to Japan.

The Anticipated Pattern of Development

Each of the three major operations referred to above has an active exploration and development programme underway. International Nickel is currently spending approximately $100 million to expand its nickel capacity from 50,000 to nearly 90,000 tons annually. This will be accomplished by opening three new mines and increasing refinery capacity. Hudson Bay Mining and Smelting is opening four new mines adjacent to Flin Flon in order to supplement the production of ore from the original site. Sherritt Gordon is developing its Fox Lake property near Lynn Lake at a cost of $25 million, and is being assisted in financing by the Japanese who will be taking the resulting production of copper concentrates. This expansion will double the volume of ore processed by Sherritt Gordon.

In addition, other copper, zinc and nickel occurrences are present in many locations which have not yet been developed but which

are being examined carefully. These occurrences are found adjacent to presently operating mines and in other areas as yet unopened, for example, in the area to the southeast of Thompson which includes Gods Lake, Oxford Lake and Island Lake.

A 50 per cent increase in metal production in northern Manitoba and Saskatchewan can be assumed on the basis of present expansion plans. This will raise present equivalent tonnage of refined nickel, copper and zinc from around 175,000 tons to 260,000 tons by 1972. Given the geology which exists, the active search for economic ore bodies and expected markets, it is generally accepted that base metal production will continue to grow in the subsequent period. A volume of 350,000 tons is quite possible by 1985.

Deposits in the Northwest Territories may also become operational by 1985, but the likelihood of volume shipments through Churchill is small. In any case, Chesterfield Inlet some 400 miles to the north is a more promising outlet for Territorial shipments than is Churchill.

<u>Potential Exports of Base Metals</u>

Canada's importance as a supplier of base metals to European and other world markets is well known. Furthermore, expansion programmes now under way indicate that Canadian producers should at least maintain their present share of expanding world sales. An optimistic outlook seems entirely justified.

What is more to the point and relative to Churchill is that Western Europe accounts for as much of the Canadian export tonnage of nickel, copper and zinc as does the United States (approximately 42 per cent in 1967). This situation is very different from newsprint, lumber and many other items where the United States market absorbs the larger share. Considering the West European markets facing Canada, it would appear that Churchill is in an excellent position to capture some of the trade from Thompson, Flin Flon and Lynn Lake.

But such has not been the case in the past. External trade data from the Dominion Bureau of Statistics indicates that minerals are less than one per cent of export tonnage through Churchill in an average year. This is less than three per cent of total base metal output in the region, and even if output were doubled it is unlikely that the trade through Churchill would increase to substantial tonnages. The pattern of shipments from this general region of Canada has been into United States markets and even Japan, while only a small portion has reached offshore markets via eastern Canadian ports or Churchill. Transportation has obviously been an important factor.

It is conceivable that a doubling of the shipping season or a sharp reduction in cargo rates could influence the pattern, particularly for refined metal, which would be handled by conventional loading methods at Churchill. Mineral concentrates might be shipped

in drums or in bulk, and in the latter case would require special handling facilities which would hardly be warranted if they were to be used for only a fraction of the year. Even if a proportion as high as 20 per cent of the refined metal from Thompson and Flin Flon could be shipped through Churchill, this would be less than 40,000 tons per year at today's production levels. The high ratio of value to weight means that a large dollar value figure is related to a relatively small tonnage. It also means that delays in shipping are costly and this precludes stockpiling of metal at Thompson or Churchill for extended periods.

The Potential Export of Sulphur and Potash

The possibility of shipping potash to export markets through Churchill have been examined in detail and have been virtually ruled out during the entire forecast period on the grounds that a volume market cannot be anticipated in Western Europe. This is the only likely area which could be served more economically via Churchill than from other Canadian ports.[2] There is a market for Canadian sulphur in Europe, however, and the issue is whether Alberta producers would have a transportation cost advantage by shipping through Churchill. The estimated rail and ocean freight charges from sulphur

[2] See Appendix G, Volume II.

processing plants in Alberta are shown in Table 21. The cargo rates listed here represent trip charters for both sulphur and potash from Vancouver to Belgium/Holland, and trip charters for heavy grain from Churchill to Belgium/Holland.

TABLE 21

APPROXIMATE SULPHUR FREIGHT COSTS
TO BELGIUM/HOLLAND FROM CALGARY
(Dollars Per Long Ton)

	Via Vancouver	Via Churchill
Rail	$ 9.00 (642 miles)	$15.00 (1,217 miles)
Ocean	6.00	5.00
	$15.00	$20.00

Note: Estimated on the basis of actual rate experience.

The above rail rate from Calgary to Vancouver has been reduced recently for unit trains, resulting in a further saving on this route of about $1.00 per ton.

It is evident that an ocean freight saving of $1.00 per ton via Churchill is not enough to offset a minimum rail handicap of $6.00 per ton. No further consideration need be given to higher costs of handling and loading at Churchill or to other cost considerations which only worsen the competitive position of sulphur via this route.

Potential Exports Through Churchill

On the basis of this analysis it is concluded that shipments

of refined minerals and concentrates through Churchill cannot be expected to exceed 50,000 tons per year by 1985. It is our opinion that even this volume will be difficult to achieve in the absence of any appreciable lengthening of the shipping season and some softening of cargo and insurance rates on outbound traffic through Churchill. When compared with a steady flow of wheat currently averaging 600 to 700 thousand tons annually, base metals are insignificant and they are expected to continue to be so in the future.

CHAPTER 7

PETROLEUM

Canada's Petroleum Resources

The objective of this section is to appraise the prospects of moving Canadian crude oil from Alberta through the Port of Churchill to export or domestic markets. This assessment covers the period to 1985. The possibility of shipments of both "conventional" and Athabasca tar sands crude will be considered.

In the context of world oil, Canada and the United States are high cost producers to such an extent that crude oil from nearly any other major producing area of the world could be landed on either their east or west coasts at substantially lower prices than from domestic sources. In contrast to the Middle East price of about $1.40/bbl., Canadian oil of similar quality today receives about $2.40/bbl. f.o.b. the Edmonton area, and United States oil receives about $3.10/bbl. f.o.b. East Texas. The high price structure in North America relative to the rest of the world is maintained through both implicit and explicit import controls by Canada the United States. The Middle East and North African areas are the world's lowest cost producers and possess by far the greatest proportion of world proved reserves (see Table 22). Approximate crude oil selling prices in 1967 for major world producing areas are shown in Table 23.

Shipments Through Churchill to Eastern Canada

The most logical markets for crude oil moving through the Port of Churchill, i.e., those markets where Canadian oil would stand the best chance of being competitive with oil from other sources, would be Eastern Canada and Western Europe.

Quebec and the Atlantic provinces import all of their crude oil requirements from foreign sources, and this amounted to some 435,000 b/d in 1966. Most comes from Venezuela (217,000 b/d) and the Middle East (205,000 b/d). Middle East crude can be landed in Montreal for approximately $2.25 U.S./bbl. This is based on a Persian Gulf price of $1.40/bbl., tanker freight from the Persian Gulf to Portland, Maine, of $0.74/bbl.[1], and a pipeline tariff from Portland to Montreal estimated at $0.11/bbl.

In contrast the price of Canadian oil via pipeline to Montreal would be over $3.10/bbl.: United States consisting of a basic price of $2.40 f.o.b. Edmonton plus a pipeline tariff in the order of $0.70/bbl. Also further allowance would have to be made for new storage facilities and modification which would be necessary to the Montreal refineries to enable them to process the somewhat different Canadian crudes. It is clear that Canadian crude at present prices is not competitive in this market.

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[1]Tanker rates of INTASCALE (International Tanker Nominal Freight Scale) minus 55 per cent have been assumed.

TABLE 22

WORLD CRUDE OIL RESERVES[a] - SELECTED COUNTRIES

	Canada	United States	Venezuela	Middle East	North Africa	U.S.S.R.	World Total
	(billions of barrels)						
1950	1.2	24.6	9.5	33.0		4.3	77.0
1951	1.4	25.3	9.0	41.6		7.5	90.2
1952	1.7	27.5	10.0	51.3		7.6	103.7
1953	1.8	28.0	8.9	64.8		9.0	118.6
1954	2.2	28.9	9.9	78.2		9.0	135.2
1955	2.5	29.6	10.9	97.5		9.5	158.1
1956	2.8	30.0	12.0	126.3		10.0	189.3
1957	2.9	30.3	15.3	160.9		23.0	237.5
1958	3.2	30.5	16.8	163.2		24.3	264.4
1959	3.5	30.5	16.5	174.0		26.0	273.2
1960	3.7	31.7	18.0	181.4		28.0	291.1
1961	4.2	31.6	18.5	183.2		31.5	299.1
1962	4.5	31.8	17.6	188.2		32.6	306.2
1963	4.9	31.4	17.0	194.0		28.5	309.6
1964	6.2	31.0	17.2	214.7	15.6	33.0	341.7
1965	6.7	31.4	17.4	228.2	20.2	35.0	365.0
1966	7.8	31.4	16.9	241.4	22.6	38.0	388.0
1967	8.2	31.4	16.0	247.7	29.1	38.0	399.5

Source: Canadian Petroleum Association, Statistical Year Book, annual. American Petroleum Institute, Petroleum Facts & Figures, biennial. World Oil, weekly.

[a]Does not include reserves of natural gas liquids.

Shipments via Churchill would not improve the situation. Only if the most favourable of conditions were to exist, i.e. a large volume throughput and a 12 month shipping season, could the tariff via Churchill to Montreal be expected to compete even with the direct pipeline route from Edmonton.

TABLE 23

APPROXIMATE WORLD CRUDE OIL SELLING PRICES, 1967

Area	Approximate Price[a] (U.S.$, f.o.b.)
Middle East	$1.40 (Persian Gulf)
North Africa	$2.00 (Gulf of Sirte)
United States	$3.10 (East Texas)
Canada	$2.40 (Edmonton)
Venezuela	$2.50+ (Puerto la Cruz)[b]
Indonesia	$1.75 (Lutong, Sarawak)
U.S.S.R.	by negotiation

[a]For crudes of about 35° API gravity, except for Libyan which is 39° - 40°.

[b]Price varies considerably depending on destination.

A pipeline from the Edmonton area or Athabasca tar sands to Churchill by the shortest route would be over 800 miles in length. Assuming a 24 inch diameter line with a continuous 12 month throughput of some 250,000 barrels per day would result, the pipeline tariff would be roughly $0.40 U.S. per barrel. This estimate is based on the Trans Mountain pipeline from Edmonton to Burnaby, British Columbia, a distance of 824 miles, which carries a tariff of $0.37 U.S. at a throughput of approximately 250,000 b/d. The tariff for smaller lines with lesser throughput would be considerably higher. It is obvious that higher tariffs would also result if shipments

through the pipeline were to be made for only part of the year.

Adding a tanker rate from Churchill to Montreal of approximately \$0.30/bbl. would mean that even under the favourable assumptions described above the total per barrel tariff via Churchill would be in the same \$0.70/bbl. range as the tariff via direct pipeline to Montreal.

An alternative pipeline route would be to tap off the existing Inter Provincial Pipeline at its closest point to Churchill, near Regina, and build a new line from that point to Churchill. However on examination it is obvious that this is a less desirable choice than the Athabasca - Churchill system. The line from Regina to Churchill would be nearly as long as the direct line from Edmonton. Also the large throughput which would be necessary through this line to obtain a reasonable per barrel tariff would require that a parallel line or loop be added to the Inter Provincial line between Edmonton and Regina. The total amount of pipelining involved under this scheme therefore would be much greater.

A third transportation alternative would be rail freight from the Inter Provincial Pipeline at Regina via Canadian National Railway to Churchill, a distance of 845 miles. However, the cost of rail freight is high compared to continuous pipeline operation. A rule of thumb figure for rail costs is 3/4 cents per ton mile which would mean a transportation cost of \$0.87 per barrel from Regina to Churchill. The pipeline tariff from Edmonton to Regina would be in the order of \$0.20/bbl. for a total figure of well over \$1.00/bbl.

Even under the best of the alternatives discussed, i.e. a total cost of transportation to Montreal through Churchill of $0.70/bbl., an f.o.b. Alberta crude oil price of $1.55 United States ($2.25 - $0.70) would be necessary to displace Middle East crude in the Montreal area. This could not be accomplished by crude from conventional sources largely because of Alberta government and industry pricing policy which maintains prices at existing levels through a scheme of prorationing of production. It is not conceivable that a lower schedule of prices for shipments to Montreal could or would be instituted.

Production from tar sands operations also would not be able to meet a price in the order of $1.55/bbl. even assuming that output from the tar sands could be marketed outside of the existing structure of Canadian prices. This would appear much too low a figure for profitable tar sands operations, at least by present day technology. By all reports the Great Canadian Oil Sands project at Fort McMurray will be only a marginal operation at present prices in the order of $2.40 U.S. f.o.b. Edmonton.

Venezuelan crude oil costs more landed in Eastern Canada than Middle East crude and would be somewhat easier to displace on a price basis. However, because of some nonprice reasons it would be equally impractical to think that this would occur. According to a general understanding among Canada, the United States and Venezuela, Canadian oil is allowed considerable access to the United States midwest markets on the understanding that Venezuelan oil be allowed access

to Canada east of the Ottawa Valley. This arrangement forms part of the basis of Canada's National Oil Policy.[2] Implied in the policy is the adoption of a continental rather than a nationalistic oil programme. Though first enunciated in 1961 the policy is still basically the same today and it seems logical to think that it will remain so.

If Canadian oil were to displace that from Venezuela in Eastern Canada, Venezuela would nearly certainly be allowed greater access into the United States market and to a large extent at the expense of Canadian exports into the United States midwest. Canada would thus sacrifice more profitable shipments to the United States in exchange for less profitable ones to Eastern Canada. In addition, if the crude shipped to Montreal was from the tar sands then, this synthetic crude would in effect be displacing markets for conventional crude. This is the antithesis of the Alberta Government tar sands policy and it seems reasonable to assume because of this that no tar sands development permit would be granted if Eastern Canada were to be the proposed market area.

Shipment Through Churchill to Western Europe

Turning to Western Europe it can be seen from Table 24 that its requirements for crude oil are virtually all met by Middle East or North African sources.

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[2]This policy is set out in Appendix F, Volume II.

The delivered price of Middle East oil to the United Kingdom is presently in the order of $2.00/bbl., U.S. consisting of a Persian Gulf price of about $1.40/bbl. plus tanker freight of roughly $0.60/bbl. via the Cape of Good Hope. Libyan crude is higher gravity and contains less sulphur than that from the Middle East. Using an f.o.b. Libya price of $2.00/bbl. the delivered price to the United Kingdom would be roughly $2.20/bbl., a reasonable premium over the Middle East crude because of quality.

Assuming that Canadian tar sands crude would be closer to Libyan crude in quality than to Middle East means a United Kingdom competitive price of $2.20 U.S. Using a total freight rate figure via Churchill of $0.70/bbl., the same that we used to Montreal, would mean f.o.b. Alberta prices in the order of $1.50/bbl. As before this seems to be much too low for a viable tar sands operation.

On a competitive price basis then Canadian oil cannot move through the Port of Churchill to serve Eastern Canadian or European markets. It has been suggested that crude might find a market with some European buyers who would be willing to pay a premium price for at least some of their requirements in order to ensure continuity of supply in the case of flareups in the Middle East and North Africa which would result in loss of supply from these sources. This strategy is possible but improbable. Unsettled political conditions have been the order of the day in Middle East and African countries since the end of World War II. Yet there continues to be a heavy reliance on these sources by Europe.

TABLE 24

WESTERN EUROPEAN IMPORTS OF CRUDE OIL AND PRODUCTS, 1967

From	Barrels/day
Middle East	4,400,000
Africa[a]	2,540,000
Venezuela	662,000
U.S.S.R.	685,000
Indonesia	35,000
United States[b]	70,000
TOTAL	8,392,000

Source: Fortune, September, 1967.

[a]Mostly Libya, but also Algeria and Nigeria.

[b]Imports from the United States are 98 per cent refined products.

The Future Outlook

Based on the foregoing discussion it is concluded that Canadian oil is not competitive today in Eastern Canada and Western Europe and could not economically be moved through the Port of Churchill to these markets even if it were technically feasible. What is the outlook for the future?

The O.E.C.D. in their 1966 study "Energy Policy - Problems and Objectives" estimated that the world requirements of primary energy in 1980 would be 8,200 million tons of oil equivalent, an annual rate of increase from 1964 levels of just under 5 per cent.

Extending this growth rate to 1985 and assuming oil to continue increasing its share of the market, but at a slower rate than previously due to increasing use of natural gas and nuclear energy, a future growth of world demand for oil and oil products is postulated at 6 per cent per year.

The world use of liquid hydrocarbons (crude oil and natural gas liquids) stood at 12.5 billion barrels per year in 1966. In 1985, then, it is considered that some 37.5 billion barrels will be required. This means that proven reserves of at least 420 billion barrels would be necessary in 1985 to ensure that this demand could be met.

World reserves over the past 10 years have grown at an annual net rate of just over 5 per cent. If this rate were to be continued to 1985, proved reserves at that time would be about 930 billion barrels, resulting in a supply capacity over double that required to meet demand. To meet the minimum net increase in reserves of 32 billion barrels, that is suggested will be necessary, would mean a future rate of increase of less than ½ per cent per year, much less than has been experienced in the past.

The outlook for crude oil then to 1985 is that it will be in plentiful supply from sources no costlier and perhaps cheaper to develop than those presently being utilized.

The whole of the previous discussion can be summed up by saying that if the price of oil were set solely by competitive forces, no increases would be expected in its real price over the period

under study. In fact the most reasonable conclusion would be that the price would continue to fall.

One other factor reinforcing the above conclusions that there will be a continuing downward pressure on world oil prices is that future tanker rates will very likely be lower than they are today. Over the past decade an increase in the size of tankers and a reduction in construction costs has resulted in a downward trend in transport costs. The economic advantage of large tankers can be very great. The O.E.C.D. suggests that on the basis of current construction costs unit transport costs using tankers of 100,000 dead weight tons would be less than half those for tankers of 20,000 dwt. The average size of today's tanker fleet is approximately 30,000 dwt. The trend today is certainly to tankers of the 100,000 dwt. class and over and oil tankers now on order from the world's shipyards average well over 100,000 dwt. The largest tanker afloat today exceeds 300,000 tons. Factors other than construction costs suggesting further decreases in tanker freight costs are:

- reduction in unit operating costs of the larger tankers through automation and fuel savings, and
- modernization of port installations.

From the above discussion it is concluded that Canada's competitive position vis-a-vis the rest of the world cannot be expected to improve significantly between now and 1985.

The possibility that Canadian oil might move to Europe for security of supply reasons, however, cannot be entirely rejected.

There is no economic basis however for estimating how much might be exported in response to a demand of this type. It is clear of course that if Canadian oil were to fill the strategic role of a secure source that movements through Churchill would have to be on a 12 month basis. The only realistic conclusion is that there will be no movement of crude oil through the Port of Churchill before 1985. The recent discovery of what appears to be a very substantial oil field on Alaska's Arctic coast does not affect this conclusion in any way.

Potential Exports - Port of Churchill

In the context of world oil, Canada and the United States are high cost producers. Canadian oil cannot move to any world market except the United States on a price competitive basis.

The most logical markets for Alberta oil shipped through Churchill would be Eastern Canada and Western Europe. However even in these areas Canadian crude is not competitive. Middle East or North African crudes could be landed in either of these locations for less than existing Alberta prices at the wellhead.

It has been suggested that oil from the Athabasca tar sands might find a market with some European buyers willing to pay a premium price for at least part of their requirements in order to ensure continuity of supply from a secure source. It is considered that this is improbable but a possibility which cannot be rejected completely. However it is clear that if Canada were to fill this role, then movements

of crude oil through Churchill would have to be on a 12 month basis and could not be justified by any economic criteria.

A study of future supply and demand patterns suggests there will be continuing downward pressure on the world price structure. The outlook to 1985 is that world crude oil will be in plentiful supply from sources no costlier, and perhaps cheaper, than those presently being utilized.

Given this evidence it is concluded that other than for local use there will be no movement of crude oil through the Port of Churchill to 1985 regardless of any extension of the navigation season and application of technological innovation in shipping.

CHAPTER 8

POTENTIAL IMPORT CARGO

The Churchill Hinterland

In general the Churchill Hinterland for inbound cargo is confined to the Province of Saskatchewan and a portion of Manitoba. Furthermore, with very few exceptions, only European countries can ship to this Hinterland at a cost advantage.

The Port of Churchill provides this portion of the prairie region with a direct link with seaborne shipping. Shipping statistics show that total unloadings at this port have recently varied from a high of 71.9 thousand tons in 1960 to a low of 17.5 thousand tons in 1965. Since 1961, Churchill has continually received a smaller and smaller share of total Canadian unloadings -- in 1966, only .03 per cent of Canadian unloadings in foreign shipping was unloaded at Churchill.

With the exception of 1959 and 1966, gasoline and fuel oil composed over 90 per cent of the foreign tonnage unloaded at Churchill during the 1958-1967 period. However, this volume was not large -- it amounted to less than one per cent of total Canadian gasoline and fuel oil unloadings. Distilled alcoholic beverages and bricks and tiles were important imports into Churchill, amounting to approximately two or three per cent of total Canadian unloadings. Structural glass and chemicals, while identified as significant imports into Churchill, amounted to less than one per cent of the total Canadian unloadings of these commodities.

In short, Churchill has not been a major port of entry for imports into the prairie region -- it can be estimated that less than one per cent of the dollar value of prairie imports enter via this route. Certain commodities (cars, tractors, alcohol) are shipped to Saskatchewan -- but the volume is very small. Generally, cargo tonnage unloaded at Churchill is destined primarily for local use in the Hinterland (i.e. largely Saskatchewan with some destined for Manitoba).

Nature of Imports Into the Prairies

Railway statistics identify a large portion of cargo shipped into the prairies from eastern Canada and British Columbia -- some of the cargo having been produced in Canada. These statistics emphasize that prairie import demand exists primarily for manufactured goods. In 1964-1965, roughly 90 per cent of the railway tonnage shipped from eastern Canada consisted of manufactured and miscellaneous items.

Railway statistics provide an indication of the east-west flow patterns, and the degree to which goods flow into the prairies from the east rather than from the west. For example, this data indicates that Manitoba and Saskatchewan are supplied mainly from eastern Canada -- over 90 per cent of the manufacturing and miscellaneous shipments to these provinces come from eastern Canada, with Ontario being the major point of origin. Finally, the rail statistics stress the importance of industrial and population

demand in overcoming transportation costs -- it is estimated that Ontario, Quebec and the Maritimes each shipped more manufacturing and miscellaneous tonnage to British Columbia than to Saskatchewan during the 1964-1965 period. Further, while British Columbia supplied over 50 per cent of Alberta's demand for manufacturing items, Ontario shipped 747,000 tons to Alberta -- a larger volume than Ontario shipped to any other Prairie Province.

Information concerning direct import flows into the prairie region is summarized in Table 25, and on the basis of available statistics, it is not possible to provide more than the foregoing general indication of flow patterns into the individual Prairie Provinces.

TABLE 25

IMPORT FLOW INTO PRAIRIE PROVINCES

	Alberta	Saskatchewan	Manitoba	Total Prairies
		(per cent)		
From Ontario	12	6	10	28
From Quebec	2	-	3	5
From Maritimes	-	-	1	1
Total From Eastern Canada	14	6	14	34
From British Columbia[a]	14	1	1	16
From South[b]	-	-	-	50
From Churchill[b]	-	-	-	Less than 1

Source: Estimates based on Dominion Bureau of Statistics Railway Statistics; Board of Transport Commissioners Waybill Analysis; Dominion Bureau of Statistics Trade of Canada, 65-201 and unpublished Dominion Bureau of Statistics material on imports to Prairie Provinces.

[a]Per cent of total prairie imports of manufacturing and miscellaneous railway tonnage, 1964-1965.

[b]Per cent of total import value into prairies, 1964.

These statistics suggest a stress on manufactured imports with normal import (in comparison to Canada) traffic from the south, a large flow of imports from eastern Canada into Manitoba and Saskatchewan, and an insignificant flow of imports from Churchill and the Maritimes.

Prairie Import Demand Through Canadian Ports

The foregoing analysis of direct shipments into the prairie region highlights the overwhelming importance of manufactured product imports. It would appear that the prairie demand for primary products transported by ship is extremely limited. Furthermore, direct shipments show that roughly half of the prairie import demand is met by east-west, rather than north-south shipments. While it is clear that roughly 90 per cent of these east-west shipments consist of manufactured and miscellaneous items, on the basis of direct shipment statistics, it is concluded that:

1. Demand in the Prairies, and particularly in the Churchill Hinterland is so small that it does not justify complete shipload movements from specific foreign ports.

2. Prairie demand for such overseas imports is not satisfied to any significant extent by shipments via United States ports.

3. The east and west coast Canadian ports satisfy the bulk of import demands for manufactured commodities.

It is also concluded that by and large cargoes shipped from overseas countries would not be shipped to the Prairie Provinces unless they were unloaded at the following major Canadian ports: Halifax, St. John, Montreal, Quebec, Toronto, Hamilton, Port Arthur-Fort William, Vancouver. Thus, the potential supply of shipping

imports into the prairies is represented by the total unloadings of foreign shipping at these major ports and at the Port of Churchill

Table 26 shows the per cent of total Canadian foreign cargo unloadings shipped to the major Canadian ports in 1966. However, not all unloadings are relevant for this study -- primary products, for example, would not tend to filter through to the prairies in any significant quantity. Consequently, for the purposes of this analysis, unloadings have been classified into two groups: 1) bulk cargo, consisting of goods destined mainly for industrial use; and 2) general cargo, consisting mainly of finished goods destined for consumer use.[1]

Bulk cargo consists mainly of bituminous coal, crude petroleum, fuel oil, iron ore and concentrates, aluminum ore and concentrates, and corn -- in 1965, for example, these items accounted for 85 per cent of Canada's bulk cargo foreign unloadings, with bituminous coal alone accounting for 32 per cent. As the definition implies, bulk cargo accounts for the major portion of total tonnage unloadings. During the 1956-1966 period, between 89 and 92 per cent of all cargo unloaded consisted of bulk cargo, while general cargo accounted for only 8 per cent to 11 per cent of total unloadings.

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[1] General cargo is defined to be all items other than the bulk cargo items and is described in Appendix H, Volume II.

TABLE 26

PER CENT OF TOTAL IMPORT UNLOADINGS
AT MAJOR PORTS - 1966

Port	Per Cent of Total
Vancouver	3.5
Churchill	.03
Lakehead	.8
Hamilton	13.8
Toronto	6.0
Montreal	12.2
Quebec	2.2
St. John	5.6
Halifax	8.0
Total Major Ports	52.1

Source: Dominion Bureau of Statistics, Shipping Report.

TABLE 27

PER CENT OF TOTAL GENERAL CARGO UNLOADINGS
AT MAJOR CANADIAN PORTS - 1963 THROUGH 1966

Port	Per Cent of Total
Vancouver	16.0
Churchill	.05
Lakehead	1.0
Hamilton	5.0
Toronto	12.0
Montreal	35.0
Quebec	3.0
St. John	5.0
Halifax	5.0
Total Major Ports	82.0

Note: Per cent to Pacific Ports	20
Per cent to Lakehead Ports	22
Per cent to Atlantic Ports	57
Per cent to Ontario Ports via St. Lawrence	16

Source: Dominion Bureau of Statistics, Shipping Report.

Table 27 shows the distribution of general cargo unloadings between the major Canadian ports during 1963-1966 -- the pattern differs significantly from that of total cargo unloadings. Vancouver's share rises to 16 per cent from 4 per cent, Montreal's share rises to 35 per cent from 12 per cent, and Toronto's share rises to 12 per cent from 6 per cent. Hamilton's share of unloadings declines from 14 per cent to 5 per cent -- the percentage unloaded at other major ports remains small and unchanged. Montreal, followed by Vancouver and Toronto, rank as the major unloading points for general cargo tonnage -- over 50 per cent of Canada's general cargo shipping imports were unloaded at Montreal and Vancouver alone.

Table 28 shows the distribution of general cargo unloadings between the major Canadian ports during 1956-1958, prior to the completion of the St. Lawrence Seaway. By comparing Tables 3 and 4, it will be noted that the Atlantic ports' share of general cargo tonnage unloadings has dropped from approximately 64 per cent to 57 per cent since the Seaway's completion, while the Great Lakes port share has risen from 13 per cent to 22 per cent. The percentage of general cargo unloaded at Pacific ports has dropped only slightly. During the 1956-1966 period, the percentage of Canada's general cargo unloaded at Montreal, St. John, Halifax and Churchill has dropped while the percentage unloaded at Toronto, Hamilton, Port Arthur-Fort William and Quebec has risen. The volume of cargo shipped to Ontario ports via the St. Lawrence has jumped from 175,200 tons in 1956-1958 (4 per cent of total general cargo) to 718,000 tons in 1963-1966

(16 per cent of total general cargo).

Despite the increased importance of Great Lakes ports for overseas general cargo inbound since the completion of the Seaway, it is clear that the vast majority of general cargo carried via the St. Lawrence to Ontario ports is destined for Toronto and Hamilton.

TABLE 28

PER CENT OF TOTAL GENERAL CARGO UNLOADINGS AT MAJOR CANADIAN PORTS - 1956 THROUGH 1958

Port	Per Cent of Total
Vancouver	16.0
Churchill	.07
Lakehead	.2
Hamilton	1.0
Toronto	3.0
Montreal	41.0
Quebec	2.0
St. John	7.0
Halifax	7.0
Total Major Ports	77.3

Source: Dominion Bureau of Statistics, Shipping Report.

Note:		
	Per Cent to Pacific Ports	23
	Per Cent to Great Lakes Ports	13
	Per Cent to Atlantic Ports	64

During 1963-1966, 65 per cent of this cargo was unloaded at Toronto, 24 per cent at Hamilton and 4 per cent at Port Arthur-Fort William. It does not appear that Port Arthur-Fort William acts as a major transhipment port for imports into Western Canada --

these latter ports accounted for only 4 per cent of the import traffic travelling up the St. Lawrence River and one per cent of all Canadian general cargo (approximately 48,000 tons) during the period 1963-1966.

In order to estimate the past and future demand of the prairie region for general cargo imports unloaded at specific major Canadian ports, it is necessary to make specific assumptions. In particular, estimates are based upon the following assumptions:

1. Residents of the Prairie Provinces demand a share of general cargo unloadings from the major Canadian transhipment ports that is roughly equal to the share of Canada's population living in these provinces.

2. General cargo imports through a particular port are a function of transport costs, population and general economic characteristics; given the area over which a port has a transport cost advantage, it is possible to estimate on the basis of the area's population the volume of general cargo imports flowing into the area.

3. All major ports have the same unloading and storage facilities.

4. General cargo that could be potentially shipped via Churchill is general cargo which has been or would be otherwise unloaded at the specified major Canadian ports.

5. In the past, the following areas have been serviced by the specified major ports:

   Vancouver - British Columbia and Alberta.

   Halifax and St. John - Maritime provinces plus some 250,000 people in Ontario and Quebec.

   Toronto, Hamilton, Port Arthur-Fort William - 5,300,000 people in Ontario in 1964-1966.

   Montreal, Quebec - the remaining population of Quebec, Ontario, Manitoba and Saskatchewan.

TABLE 29

ESTIMATED EAST-WEST FLOW OF GENERAL CARGO,
INTERNATIONAL SHIPPING TONNAGE TO PRAIRIES
1966

	Alberta	Saskatchewan	Manitoba	Total Prairies
Tonnage Shipped:				
From Vancouver	322,000	-	-	322,000
From Montreal	-	225,000	227,000	452,000
Total	322,000	225,000	227,000	774,000
Approximate Per Cent of Total	42	29	29	

Source: Hedlin, Menzies & Associates Ltd.

Note: The Port of Churchill unloaded 3,300 tons of general cargo (less than 1 per cent of Prairie total) in 1966.

Churchill - no significant share.

(These assumptions are based on the previous analysis of direct import shipment, combined with regression analysis between the tonnage unloaded at these major ports and the population serviced by these ports. Furthermore, the 1958 study of the Montreal Research Council on the potential import of the Seaway on Montreal was utilized.)

6. There will be no revolutionary technological change to upset the relative advantages of sea transport as compared to other modes of transport. (Based on analysis presented in studies on the Seaway by the Stanford Research Institute and J. Kates and Associates.)

7. The world and North American economy will remain stable to 1985 with no major wars, depressions or drastic changes.

8. The proportion of imports entering Canadian provinces via the United States will not change.

Given these assumptions, Table 29 shows the estimated flow of general cargo tonnage into each Prairie Province in 1966. It is estimated that about 225,000 tons entered Saskatchewan, and 227,000 tons entered Manitoba, the vast majority of this originating in Montreal. Given these estimates, less than one per cent of prairie general cargo imports enter via Churchill -- approximately 50 per cent enter via Montreal destined primarily for Manitoba and Saskatchewan.

Based upon past and projected rates of economic growth it is estimated that the general cargo tonnage that will be demanded by Saskatchewan residents in 1970, 1975, 1980 and 1985 will be as shown in Table 30.

Historically the Hinterland for imports through the Port of Churchill has mainly been Saskatchewan but comparative costs of transportation indicate that a portion of Manitoba might logically

be included as part of the Hinterland.

TABLE 30

ESTIMATES OF GENERAL CARGO DEMAND, SASKATCHEWAN, 1970-1985 (thousand tons)

Ranges	1970	1975	1980	1985
Low	180	190	201	211
Medium	248	258	269	279
High	316	326	337	347

Source: Hedlin, Menzies & Associates Ltd.

Comparative Transportation Costs

The next step in determining potential imports through the Port of Churchill is to examine transportation costs from various export sources via the different Canadian ports. These transportation costs on commodity imports to the Churchill Hinterland must of course include both rail and ocean costs. In cases where commodity movements are presently nonexistent rail and ocean rates through Churchill have been estimated on the basis of movements which exist through other ports. The estimated rail rates from the ports of Vancouver, Montreal and Churchill to major Prairie cities are shown in Table 31.

TABLE 31

ESTIMATED AVERAGE RAIL RATES ON CONSUMER AND INDUSTRIAL GOODS
($/cwt)

To	From Vancouver	Montreal	Churchill
Edmonton	1.25	3.17	1.83
Calgary	1.10	3.29	1.97
Regina	1.74	2.55	1.37
Saskatoon	1.71	2.70	1.37
Winnipeg	2.28	2.01	1.56

Source: Estimates based on information from the Canada Transportation Service.

In many instances these rail rates are based on volume movements and because of the criteria used for rate determination by railroads, the rail rates estimated for the Churchill movement would only be applicable in cases where traffic was heavy. Generally lower rates on import commodities result in the displacement of some domestic traffic. Under normal circumstances, if import traffic is more profitable to the railway than the domestic traffic it replaces, the railways will tend to encourage the import. If, however, the import movement is not as profitable as inbound and outbound traffic of the domestic supplies, the railway will tend not to offer any advantages to the importer, except insofar as encouraging movement via a port served by that railway as opposed to a United States port.

In regard to Churchill the rates shown in Table 31 would

probably be applicable only if import movements became heavy and did not affect to any great extent revenue traffic over the longer eastern route.

The ocean rates from the United Kingdom and Western Europe to the three Canadian ports are shown in Table 32. Where ocean movements do not now exist, these rates have been estimated on the basis of existing movements. The estimated rates may not be applicable in cases where inbound and outbound traffic are extremely unbalanced.

TABLE 32

ESTIMATED AVERAGE OCEAN RATES ON CONSUMER AND INDUSTRIAL GOODS ($/cwt)

	From	
To	United Kingdom	Western Europe
Vancouver	4.17	4.11
Montreal	3.19	3.13
Churchill[a]	3.19	3.13

Source: Estimates based on information from the Canada Transportation Service.

[a]Dalgliesh Lines have in the past operated to Churchill from the United Kingdom with rates generally comparable to the St. Lawrence and it has been assumed that a similar rate relationship would exist for movements from Western Europe to Churchill.

Transportation rates follow traffic rather than precede it. Carriers are usually loathe to commit themselves to a rate until a regular movement has been established and they have had an

opportunity to assess actual costs of operation including those resulting from delays not always foreseen. The initial rate is usually set high enough to cover contingencies which may arise. Except for differences in cost, ocean vessels are usually indifferent as to whether any one port prospers as compared to another. The same indifference between shipping points is not always evident in the case of railway rates.

Both the rail and ocean rates which have been estimated assume that import traffic through Churchill would be heavy enough so that normal rates would apply. Based on this criteria, Table 33 provides an estimate of combined ocean and rail costs on imported goods to the prairie region which assumes that the density of the commodity traffic through Churchill would be at such a level so as to allow normal rates.

In Table 33 the estimated costs indicate that Saskatchewan and Manitoba could be considered as the Churchill Hinterland for imports from the United Kingdom and Western Europe. However, in view of Churchill's short season it would appear more reasonable, based on the comparative rate structure, to assume that the Hinterland for potential import traffic from the United Kingdom and Western Europe through the Port of Churchill would consist primarily of Saskatchewan.

In regard to Churchill, reduced rates would probably be only put into effect if import traffic materializing on the Hudson Bay line did not do so at the expense of revenue traffic over the longer eastern

route. The railways have found that where a particular rate is reduced, the result is often not an increase in traffic but rather a diversion of traffic from one line of the railway to another. Lower import rates from Churchill would most likely be diverted from existing movements on other lines and therefore it is expected that the railway would be reluctant to reduce rates on one line which would have a detrimental effect upon the profitability of another line.

TABLE 33

AN ESTIMATE OF COMPARATIVE TRANSPORTATION COSTS ON IMPORTED COMMODITIES

Prairie Destination	From The United Kingdom Through			From Western Europe Through		
	Vancouver	Montreal	Churchill	Vancouver	Montreal	Churchill
			($/cwt)			
Edmonton	5.42	6.36	5.02	5.36	6.30	4.96
Calgary	5.27	6.48	5.16	5.21	6.42	5.10
Regina	5.91	5.74	4.56	5.85	5.68	4.50
Saskatoon	5.88	5.89	4.56	5.82	5.83	4.50
Winnipeg	6.45	5.20	4.75	6.39	5.14	4.69

Source: Estimates based on information from the Canada Transportation Service.

Potential Import Traffic - Port of Churchill

If past trends continue through 1985, the vast majority of the general cargo tonnage shipped into Saskatchewan would enter via Montreal or other eastern ports. There is no reason to assume that the absolute amount entering via Churchill would increase substantially, given past trends. Even if Churchill were to handle 279,000 tons of imported general cargo which it is considered will be demanded in Saskatchewan by 1985 (see Table 30, medium projection), this would only be slightly larger than tonnage unloaded at St. John (212,000) and Halifax (214,000) in the

1963-1966 average period.

It must be stressed, however, that under no circumstances can or will the total demand of Saskatchewan mentioned above be imported via Churchill. The Churchill Hinterland is open only to those foreign countries having a transport cost advantage and this is limited to imports from European countries.

Since the Churchill Hinterland is supplied at present primarily by the Port of Montreal, the likely future pattern can only be determined by examining the country of origin for general cargo shipped to Montreal.

Table 34 shows the origin of general cargo shipments to Montreal, 1964-1966. European countries accounted for approximately 60 per cent of Montreal imports. Assuming that this share does not change significantly, an estimate of Saskatchewan demand for European general cargo imports can be made by reducing total Saskatchewan demand by 40 per cent. These estimates are shown in Table 35 and represent the potential of imports through the Port of Churchill under the best of conditions.

It is important to realize that this estimate of potential demand for general cargo imports via Churchill assumes that Churchill has the same supply facilities as other major Canadian ports. This assumption is not realistic, and thus adjustments must be made for such factors as the length of Churchill's season, the Port's unloading and storage facilities as well as the general economic character of the Port's immediate surrounding area.

TABLE 34

COUNTRY OF ORIGIN FOR GENERAL CARGO SHIPMENTS UNLOADED AT MONTREAL - 1964 THROUGH 1966

Country or Origin	Per Cent of Unloadings
United Kingdom	18
Benelux	20
Germany	6
India	3
South Africa	5
United States	5
Japan	7
Other	36
Total	100

Source: Dominion Bureau of Statistics, Shipping Report.

TABLE 35

PORT OF CHURCHILL - POTENTIAL IMPORT TRAFFIC (thousand tons)

Range/Year	1970	1975	1980	1985
Low	108	114	121	127
Medium	149	155	161	167
High	190	196	202	208

Source: Hedlin, Menzies & Associates Ltd.

General cargo unloadings tend to be significant, relative to bulk cargo unloadings, only at major Canadian ports. For example, in 1966, general cargo unloadings accounted for 46 per cent of

Vancouver's total unloadings, 26 per cent of Montreal's unloadings, 20 per cent of Toronto's unloadings, 14 per cent of Port Arthur-Fort William's unloadings, and 19 per cent of Churchill's unloadings. Furthermore, large ports tend to create economies of scale providing them with additional advantages over smaller ports -- thus, Montreal and Vancouver alone account for over 50 per cent of Canada's general cargo tonnage unloadings. It is indicated that advances in transport technology, such as containerization and the building of super ports, will further concentrate general cargo unloadings into a few major ports.

If containerization becomes widely accepted it would not seem likely that Churchill would benefit. Although some types of imports could conceivably be moved through Churchill in containers it is unlikely, because of the short navigation season and lack of export commodities which could be containerized, that the movement would become important. Rather, it would seem more likely that Churchill would suffer the loss of some import traffic to a container port having a much longer season with and a better balance between containerable imports and exports.

Finally, there is the problem of the restricted season at Churchill. The Stanford Research Institute, in its study of potential Great Lakes general cargo shipments, estimated that winter closing eliminated roughly one-third of the service area tonnage for Great Lakes ports or an amount roughly equivalent to that proportion of the

year during which the Port is closed. This estimate would be relevant as a minimum for the Port of Churchill and would mean that potential imports by 1985 could be only about 58,000 tons if present patterns persist, or as high as 167,000 tons if the Port were open all year.

CHAPTER 9

COASTAL SHIPPING

Churchill and Coastal Shipping

At present there are three main supply routes to Canada's northern territories.

1. The Mackenzie Valley served mainly from Edmonton.
2. The west coast of Hudson Bay and the central Arctic served from Churchill and Winnipeg.
3. The islands of the eastern Arctic served by sea and air from Montreal and east coast ports.

The Port of Churchill has a role in the supply of both the central Arctic and the islands of the eastern Arctic. In particular, the sea supply to settlements situated on the west coast of Hudson Bay and the airlift supply to inland settlements is an extension of the Hudson Bay Railway. The route is short and is often used to supplement the supplies from Montreal and east coast ports. The largest portion of the sea lifted supplies in the eastern and far northern Arctic are moved from Montreal by Canadian Coastguard vessels or charter ships in sufficient numbers to carry necessary supplies in the limited shipping season. On occasion Churchill is used as a staging area to supplement the sealift from Montreal. Ships sometimes make additional trips to the northern settlements by first delivering supplies loaded at Montreal and then transporting additional supplies after receiving them at the Port of Churchill.

Despite the role Churchill has as an important part of one

of the major supply routes to northern settlements, the impact of these supplies moving through the Port is very small when compared to total Port traffic.

Outbound Shipments

Total cargo loaded at the Port of Churchill for coastal shipping has not exceeded 40,000 tons in any one year. Shipments from 1957 to 1966 by product are shown in Table 36.

TABLE 36

PORT OF CHURCHILL - COMMODITIES LOADED FOR COASTWISE SHIPPING (tons)

	Oats	Hulls Screenings Chaff	Gasoline and Fuel Oil	General Cargo	Miscellaneous Cargo	Total Loadings
1957	-	2,650	85	659	5	3,399
1958	105	2,375	-	1,569	2,406	6,455
1959	3,511	-	8,011	2,022	-	13,544
1960	-	-	10,652	1,612	1,666	13,930
1961	-	-	13,268	1,819	5,586	20,673
1962	2,505	4,233	7,391	1,836	75	16,040
1963	1,872	5,386	28,832	1,513	70	37,673
1964	1,300	2,309	14,176	739	-	18,524
1965	969	4,053	-	832	4	5,858
1966	2,001	5,431	4,665	994	381	13,472

Source: Shipping Report, Part III, Dominion Bureau of Statistics, 54-204.

Not all the total loadings in the foregoing table can be considered as destined for northern settlements. The first two commodities, oats and hulls, screenings and chaff are actually a by-product of the grain cleaning operation carried out at the Port's

grain terminal facilities. These two commodities are transported by coastwise shipping to eastern Canada where they can be marketed as animal feed. Loadings of gasoline and fuel oil increased sharply from 1957 up until 1963. After 1963 loadings declined sharply. A large part of this trend can be explained by the development of a mine at Rankin Inlet in the latter part of the last decade and the cessation of operations at Rankin Inlet in 1962. This past traffic of gasoline and fuel oil for Rankin Inlet which was shipped through the Port of Churchill is an example of the extent to which the development of a northern resource can affect the Port's traffic. The trend of loadings of general cargo follows much the same pattern as gasoline and fuel oil and is tied directly to resource development activity in Churchill's northern Hinterland. The bulk of miscellaneous cargo loadings in 1958, 1959 and 1961 were comprised of coastwise shipments of wheat, metallic ores and concentrates to eastern Canada. Outside of the above three years, loadings of miscellaneous cargo has remained well under 400 tons a year.

Commodities loaded for coastwise shipping and destined for northern settlements and developments then represent only a portion of total loadings for coastwise shipping. Over the ten-year period (1957-1966) it is estimated that of the total loadings at the Port of Churchill for coastwise shipping approximately 50 per cent was directed to northern destinations. Moreover, in recent years since activity in Churchill's northern Hinterland has declined with the

termination of operations at Rankin Inlet, loadings destined for northern locations have declined to around 40 per cent of total loadings of coastwise shipping.

Inbound Shipments

Commodities carried in coastal shipping and unloaded at the Port of Churchill in the ten-year period from 1957 to 1966 were also heavily influenced by the activity at Rankin Inlet. During this period average unloadings amounted to approximately 7.8 thousand tons a year but if unloadings of ore from Rankin Inlet are excluded, average unloadings decline to approximately 2.8 thousand tons a year. The latter figure is more representative of present unloadings in coastal shipping at the Port. Unloadings of ore at the Port were reported in 1959, 1961 and 1962 and during the last decade the only other inbound traffic reported consisted of relatively small amounts of commodities classed as either general cargo or miscellaneous cargo. Even with the ore unloadings, total unloadings in coastal shipping during this period amounted to just over one per cent of total Port traffic.

Projected Coastal Trade

In the ten-year period 1957 to 1966 it is estimated that of total loading for both offshore and coastal destinations, loadings destined for northern settlements and developments averaged 1.6 per cent.

Unloadings at the Port of Churchill from northern settlements have in the past not been in large volumes nor have they been

steady. When ore was being extracted at Rankin Inlet, the ore was carried by coastal shipping and unloaded at the Port of Churchill. The amount of these unloadings at the Port of Churchill was quite substantial in the years that such ore from Rankin Inlet was unloaded. Unless, in the future, a development or developments of the Rankin Inlet type come into operation, coastwise shipping from and to the Port of Churchill will essentially remain one way. That is to say coastwise shipping from Churchill to northern settlements will continue to be primarily a supply movement.

At present resource development in Canada has been focused on the north. The future volumes of supply commodities which will be shipped through the Port of Churchill to northern settlements to a large extent depends on what resource developments will actually take place.

The range of prospects for future development in Churchill's northern Hinterland and the effect of future developments on Port traffic are very difficult to project. Perhaps no significant discoveries will be made and very little development will take place in the Hinterland. Or, one or more major discoveries might be made which could prove to be economically feasible to develop. If no major development takes place during the projection period supplies shipped north through the Port of Churchill would continue in the same volumes as has been shipped in recent years. If one or more possible resource discoveries were developed in the Hinterland the

volume of supplies might double or triple. Two projections of future coastal shipping potential to 1985 have been prepared and are shown in Table 37. The low projection presumes a continuation of the present pattern, the high projection presumes a successful resource development programme in the central Arctic.

TABLE 37

PROJECTED NORTHERN SUPPLIES MOVING THROUGH THE PORT OF CHURCHILL
(000's tons)

	Low Projection	High Projection
1970	7.5	10.0
1975	7.5	13.0
1980	7.5	18.0
1985	7.5	23.0

Source: Hedlin, Menzies & Associates Ltd.

CHAPTER 10

EVALUATION OF POTENTIAL TRAFFIC

The total projection of traffic which potentially might utilize the Port of Churchill, to a large extent, has been based on future prospects in export and domestic markets. The extent to which the port logically might serve these markets has been determined by comparing transportation costs through the Port of Churchill and other Canadian ports. The potential port traffic which has been identified in this way has been based on the assumption that there are no climatic restrictions on traffic except those related to future market demand, market location and costs which are associated with transporting these specific commodities to the market areas.

Potential Traffic

Assuming that the navigation season and port facilities would not restrict potential traffic in any way, total potential inbound and outbound traffic has been projected for 1985 at a minimum of 1.4 million tons and at a maximum of 2.5 million tons. Because of the uncertainty of domestic factors of production in the future and a wide range of export market prospects, the scope of potential traffic possibilities is very wide. The medium or most probable projection for potential traffic in 1985 is approximately 1.9 million tons, an increase of 1.2 million tons or 170

per cent over the current traffic volume which has averaged approximately 710 thousand tons annually from 1958 through 1966. Details of this medium, or most probable, traffic forecast is shown in Table 38.

TABLE 38

POTENTIAL INBOUND AND OUTBOUND TRAFFIC 1970-1985 - PORT OF CHURCHILL
(medium projection - thousand tons)

	1970	1975	1980	1985	Per Cent (Shipment) 1985
Grain	1,300	1,400	1,500	1,600	83.9
Forest Products	75	75	75	75	3.9
Base Metals	50	50	50	50	2.6
Petroleum	-	-	-	-	-
Potash	-	-	-	-	-
General Cargo	149	155	161	167	8.8
Coastal Shipping	9	10	13	15	0.8
Total	1,583	1,690	1,799	1,907	100.0

Source: Hedlin, Menzies & Associates Ltd.

The above projections could only be considered as potential port traffic if the port remained open throughout the year and facilities existed which were able to handle the projected volumes. Within the current port operating season and with the existing port facilities only a portion of this potential traffic could be handled.

Present Capacity with Current Operating Season

The current length of time the port is open alone would

significantly reduce the potential traffic discussed above since the port would not be able to serve commodities requiring regular access to the port throughout the year. This restriction imposed by the limited navigation season affects to varying degrees all the specific types of traffic that have been considered.

Even though buyers ordering wheat ex Churchill for the United Kingdom and Western Europe have in the past been able to gain a market advantage over other Canadian ports relative to the total cost of purchasing and transporting wheat to the market destination, buyers have been hesitant to order much more than 25 million bushels in any one year. It would appear that buyer hesitancy results from a number of reasons. The European harvest season coincides with the port operating season increasing demands for scarce storage space in Europe. Grain storage costs are significant and in order to minimize storage costs it is desirable on the part of the buyer, that the grain be commercially distributed with a minimum of delay. Large volumes of wheat purchased ex Churchill in the relatively short period of time the port is open which coincides with the European harvest perhaps cannot be merchandised as quickly as desirable. Other factors which contribute to the overall cost of shipping grain appear to be turnaround delays both at Churchill in the latter part of the season and at the European ports. If a more efficient pattern of vessel arrival at Churchill could be achieved, turnaround delays at the port could be reduced.

Wheat exports from Churchill between 1956/1957 through

1965/1966 averaged 20.5 million bushels annually. If buyer hesitancy were reduced wheat exports through Churchill with existing port facilities and operating season could probably be increased to 30 million bushels annually.

Exports of forest products and base metals through the Port of Churchill depend upon export market demands which exist during the time in which the port remains open and the amount of product available for export in the Hinterland during the same period of time. The cost of carrying inventories in anticipation of market demands which might materialize and make shipment through Churchill attractive is too high to warrant maintaining any substantial stockpiles. Therefore, if movement through Churchill did become attractive the volume which might be moved through this port would depend largely upon current production during the port operating season. With present port facilities and operating season it is not likely that any forest products would be exported through Churchill.

If the present market situation regarding base metals were to change and export through Churchill were to become more attractive approximately 15 thousand tons of refined or concentrated base metals exports might perhaps be shipped through the port.

That portion of general cargo which could potentially be served by the Port of Churchill during the present operating

season is quite small compared to the total potential if the port were open all year. The population and industrial base within the Hinterland are of such a size, that demands for industrial and consumer goods from the United Kingdom and Western Europe are relatively small when compared to Eastern Canada. Much of the Hinterland's demand for this type of general cargo requires that a steady but relatively small flow of commodities be maintained throughout the year. This type of distribution minimizes inventory requirements and thus reduces merchandising costs. Unless the Port of Churchill were to remain open over a substantially longer period of time there is no reason to assume that this distribution pattern will change significantly. Therefore, inbound cargo traffic through the port in the future would remain much the same as it has in the past with no substantial increase if the operating season were not to be appreciably expanded. Under these conditions it is expected that the port would serve no more than 35 per cent of projected potential inbound cargo. Present facilities would be adequate for handling this volume which would amount to 58 thousand tons annually. From 1958 to 1966 general cargo inbound has averaged approximately 41 thousand tons a year.

Coastal shipping through Churchill is limited not only because of the short operating season but also because of the magnitude of development in the Hudson Bay area which is supplied through Churchill. Even if the development of this area increased

significantly and increased coastal traffic became necessary cargo handled for supplying northern developments would probably not exceed 15 thousand tons within the present length of the navigation season. In the past coastal traffic handled by the port has averaged 24.9 thousand tons from 1958 to 1966 but this has included inbound supplies for the Churchill area and ore from Rankin Inlet. The facilities at the port are adequate for any foreseeable demands made on the port by coastal shipping.

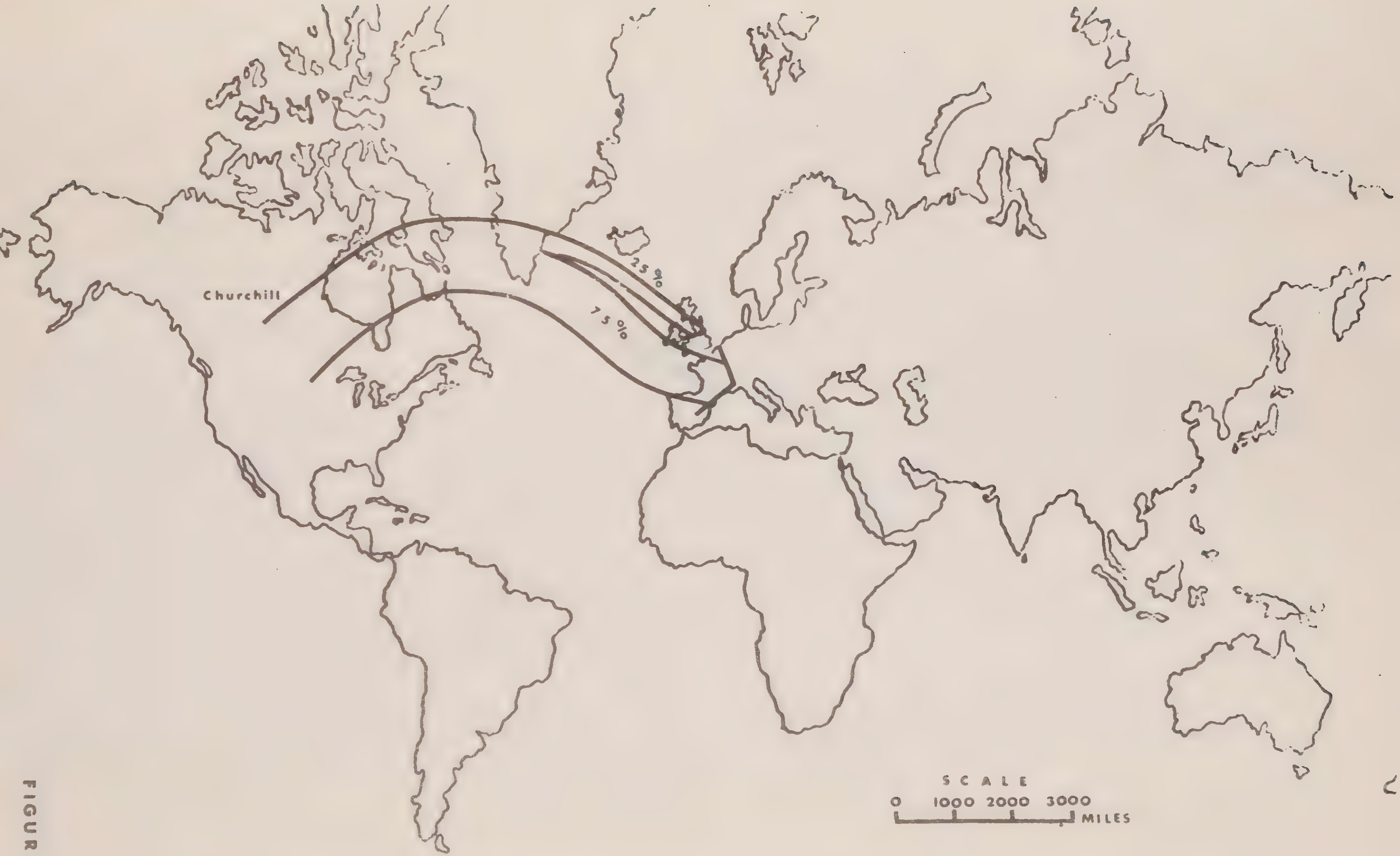
Forecast of Traffic - Current and Extended Navigation Season

In summary, it is concluded from an examination of all available evidence that if the present port facilities are not changed and the navigation season is not extended, the total traffic moving through the port by 1985 will most probably only increase by some 40 per cent over the average of the last nine years; or from approximately 710,000 tons per year to 997,000 tons per year. On the other hand, if port facilities were expanded and the navigation season were extended to a 12 month basis, 1985 traffic moving through the port would most probably increase to 1.9 million tons or some 170 per cent over current traffic volumes. Projected traffic flows based on the latter assumptions for grain, forest products and minerals are illustrated in Figures 5, 6 and 7 respectively.

The two levels of projected traffic in 1985 are shown in Table 39, which also indicates the commodities and type of traffic

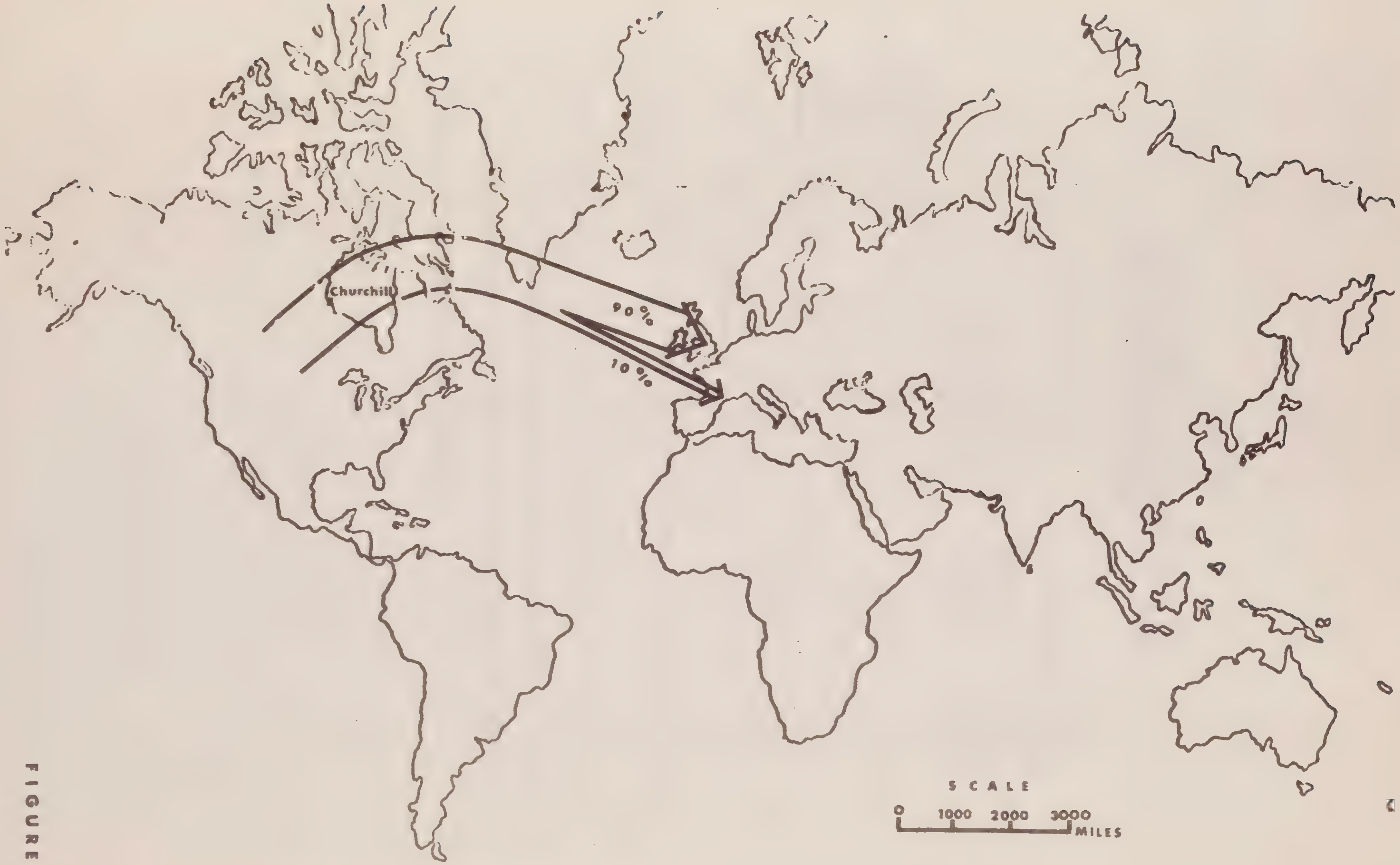
POTENTIAL GRAIN EXPORT THROUGH THE PORT OF CHURCHILL-1985-1.6 m.ton

FIGURE 5



FOREST PRODUCT EXPORT POTENTIAL — CHURCHILL 75,000.tons

FIGURE 6



EXPORT MINING POTENTIAL - CHURCHILL - 50,000 tons

FIGURE 7

TABLE 39

PORT OF CHURCHILL - FORECAST TRAFFIC
PRESENT AND EXTENDED NAVIGATION SEASON
(thousand tons)

		Projected to 1985	
	Average 1958-1966	Assuming All Year Operation	Assuming Present Navigation Season
Grain	641	1,600	909
Forest Products	-	75	-
Base Metals	3	50	15
Petroleum	-	-	-
Potash	-	-	-
General Cargo	41	167	58
Coastal Shipping	25[a]	15	15
Total	710	1,907	997

Source: Hedlin, Menzies & Associates, Ltd.

[a]Includes coastal traffic which was generated by the development at Rankin Inlet.

which would account for the increases.

The remainder of this report consists of an examination of the probability of extending the navigation season at the Port of Churchill and on the Hudson Bay Route.

PART III

TECHNICAL PROBLEMS OF FURTHER DEVELOPMENT

CHAPTER 11

THE PROBLEMS WHICH EXIST

The overriding problem at Churchill is, of course, the short length of the shipping season. There are, however, a number of minor navigational problems which affect the safety of the Hudson Bay Route and the efficiency of operation at the Port of Churchill. These problems are outlined below and the possibilities for their solution are discussed in subsequent chapters.

Length of Shipping Season

The present length of the shipping season is largely governed by the period for which insurance is available, directly or indirectly, with Lloyd's of London. Based on the use of conventional unstrengthened vessels, July 23 is the earliest date on which a ship may pass Cape Chidley at the eastern end of Hudson Strait. October 15th is the latest date for ships to leave Churchill at normal insurance rates, but a five day extension to October 20th is permitted at a 25 per cent surcharge. Some vessels from Russia and other Eastern European countries have operated outside the normal shipping season.

In practice, the river ice at Churchill begins to break up about the middle of June and the harbour itself is nearly always available for shipping by about June 21. Hudson Strait and Hudson Bay are not usually sufficiently clear of ice to enable unstrengthened vessels to pass safely until the second half of July and the official opening date of July 23rd is reasonable.

The actual closing of Churchill Harbour is determined by the date by which climatic conditions inland have become sufficiently severe to generate large quantities of slush ice in the river. This ice accumulates in the upper part of the estuary during the flood tide and then sweeps down on the ebb tide. The large quantities of slush ice, combined with the strong current along the face of the wharf, make it difficult to maintain vessels at their moorings. The date on which the harbour has had to be closed has varied from October 10th to November 13th and has averaged October 25th. The shipping route through Hudson Bay and Hudson Strait has usually remained virtually free from ice until the second week in November. The length of the shipping season in relation to ice conditions in Hudson Strait, Hudson Bay and Churchill Harbour is discussed in detail in Appendices A and B in Volume II.

Navigation Hazards and Delays

Apart from the general problem of ice outlined above and discussed in detail in Appendix A, Volume II, the main items creating hazards or delays to navigation are:

Icebergs and growlers in Hudson Strait combined with the prevalence of fog

Tidal currents at Churchill

Strong winds at Churchill

Depths in Churchill harbour and its approaches.

Icebergs and Growlers[1]

Consisting, as they do, of hard strong ice with a comparatively large portion invisible below the water surface, icebergs and growlers are more likely to cause serious damage to a vessel than floes of first year winter ice. However, icebergs, and to a lesser extent growlers, can be seen at a fair distance in clear weather by day or night. They are a hazard only in fog or driving snow in which the speed of the vessel should be reduced according to the visibility. Radar will normally indicate the presence of icebergs and growlers, but it cannot be given complete reliance. It is possible for an iceberg to present a smooth face inclined in such a way that a radar beam is deflected instead of reflected back to the ship. In the case of vessels passing through loose pack ice it is not possible for radar to distinguish between growlers and ordinary ice floes.[2]

In spite of these limitations on the effectiveness of radar, the record shows that the icebergs and growlers in the eastern portion of Hudson Strait do not represent a serious hazard to shipping during the present shipping season. In the whole period since the effective opening of the Port of Churchill in 1931, only one[3] vessel has been lost or seriously

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[1] For a definition and description of the technical terms regarding ice and ice conditions see Appendix C, Volume II.

[2] The origin and prevalence of icebergs and growlers is described in detail in Appendix A, Volume II.

[3] A Yugoslav ship sank in 1966 but the cause is not yet known officially.

damaged due to striking an iceberg or growler. In 1932 the S.S. Brightfan sank after striking an iceberg but subsequent enquiry attributed the loss to neglect of the Ship's Master to maintain a proper lookout.

Tidal Currents at Churchill

Strong tidal currents occur at the harbour entrance and along the face of the wharf.

Surface velocities of about 5.8 ft./sec. have been measured[4] at a section some 4,000 feet inside the entrance and comparison of sectional areas indicates that entrance velocities up to 9.7 ft./sec. or 5.7 knots occur during spring tides. In order to obtain good steerage at a slow speed relative to the land, ships find it desirable to enter the harbour during the ebb tide and to leave during the flood tide. This fact, combined with limitations of depth, restrict the hours during which vessels may safely enter and leave the harbour.

The configurations of the estuary upstream of the harbour is such that the ebbing tidal flow is projected towards the north bank above Cockles Point where it is deflected and then projected towards the south side where the wharf is located. The current is also attracted to the wharf by the dredged channel which accommodates a large flow along the wharf and beyond at a small hydraulic gradient. This strong ebb current has two main effects on shipping. Firstly, it

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[4] National Research Council of Canada "Feasibility of Extending Navigation Season at Churchill Harbour" December 1966, Figure 22.

restricts the period during which vessels may be turned round safely. Secondly, as described above, the slush ice brought down by the ebb current at the onset of winter creates forces against the ships which cannot be maintained at their berths, thus closing the harbour to shipping about two weeks, on the average, before shipping would otherwise need to leave.

Strong Winds at Churchill

The prevalence and direction of strong winds are discussed in Appendix A.[5] The harbour is thoroughly protected from waves generated in Hudson Bay, but the strong winds themselves cause considerable delays to shipping. Commercial vessels entering and leaving the harbour are required to have pilots, but rough weather outside the harbour often makes it hazardous for pilots to board or disembark. Strong winds also make it difficult at times to turn vessels prior to berthing or sailing. In a typical season about 10 per cent of the vessels arriving are prevented from berthing by strong winds, occasionally for periods of two or three days.

Depths in Churchill Harbour and Its Approaches

Depths at the wharf, in the remainder of the harbour and in the approaches are shown in Figures 1 and 2.[6] The depth at the grain

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[5] See Volume II.

[6] See Part I, Chapter I.

loading berths is maintained at about 32 feet. The depth of the turning basin is about 30 feet over a width of 600 feet and reduces to about 24 feet over the remaining 200 feet. The shipping channel within the harbour has a minimum depth of 24 feet whilst the approach lane outside the harbour entrance has a minimum depth of 26 feet. These latter depths restrict the departure of the larger laden vessels to a period of about two hours either side of high tide. Records for the year 1965 show that twenty-seven vessels were loaded to a draft exceeding 30 feet, seven vessels to a draft exceeding 32 feet and one vessel to very nearly 34 feet. Obviously, greater channel depths would be an advantage and would increase the range of time for departure of the larger vessels which are already restricted by currents and strong winds.

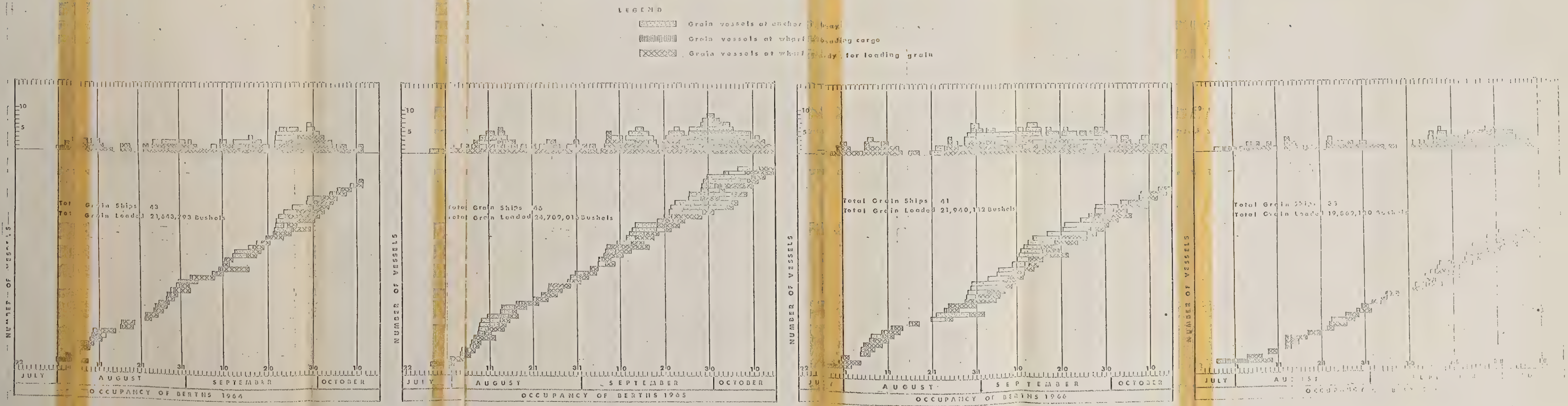
There is no direct evidence of solid bedrock in the shipping channel and "rock" indicated on the chart may be large boulders. The only positive evidence of the elevation of bedrock is given by borings along and near the line of the wharf face. These show the bedrock to be dipping in a southerly direction from 21 feet below hydrographic datum at 650 feet beyond the north end of the wharf to minus 60 feet at 300 feet beyond the south end of the wharf. This general trend suggests that bedrock might be encountered in any deepening of the channel between the north end of the wharf and the deep water at the harbour entrance.

Uneven Arrival of Vessels

The report of Sir Alexander Gibb & Partners[7] dated 1962 to the Manitoba Government drew attention to the uneven arrival of vessels and the effect which this had on port congestion towards the end of the shipping season. Figure 8 shows an analysis of recent years 1964-1967 inclusive which indicates that the situation has not improved, particularly in a peak year such as 1965. The two extra berths commissioned in 1964 have not been able to reduce the congestion because the bottleneck is the loading of grain. Whilst the loading gallery and spouts serve three berths, it is only possible to load one vessel at maximum speed because the loading of a second vessel merely reduces the rate of loading of the first vessel. It is, however, helpful to have at least two vessels berthed and available so that grain may be delivered to the second vessel when loading of the first is halted for purposes of trimming or bulkheading. The simultaneous loading of three vessels is impractical, although it may be helpful to have a third vessel berthed so that it may be inspected, ready for loading by the time that one of the other two vessels is fully loaded. Although the ability to load two or three vessels simultaneously at full speed would help to relieve periods of congestion, the basic cause of the present problem is the uneven arrival of ships combined with the strong winds

[7] Sir Alexander Gibb & Partners. "Report to Committee on Manitoba's Economic Future 1962".

PORT CHURCHILL OCCUPANCY OF BERTHS



and currents which may delay their berthing or departure. The trend towards the utilization of larger self turning vessels will tend to reduce the total number of arrivals and hence the congestion.

CHAPTER 12

LENGTHENING THE NAVIGATION SEASON

The problem of the length of the navigation season consists of two parts:

- The general problem of ice conditions in Hudson Strait and Hudson Bay. This problem is discussed in detail in Appendix A, Volume II.

- The particular problem of slush ice generated in the river and brought down on the ebb tide which closes the harbour before ice becomes a problem in the strait and the bay. This problem is discussed in detail in Appendix B, Volume II.

Problem of Ice In Hudson Strait and Bay

For many years, information regarding ice conditions in Hudson Strait and Hudson Bay was obtained almost entirely from shore stations and the reports of the Masters of ice breakers and merchant vessels. Since 1959, a complete programme of aerial observations has been undertaken and a much more reliable picture of ice conditions is now available. Since 1963, graphical analyses of the aerial observations have been published by the Meteorological Branch of the Department of Transport.

Apart from the general background data now available, Masters of vessels have ready access to up to date information about ice conditions through the Ice Operations Office at Churchill and the Field Ice Forecast Office at Frobisher.

A seasonal "outlook" of ice conditions is also published but it is made clear that this is prepared only to assist planning

and is not intended for actual operations. Although long range forecasts can give some indication of the general severity of ice conditions, they cannot predict local conditions more than a few days ahead because these conditions depend on the strength and direction of winds which cannot be forecast long in advance.

The average ice conditions in the strait and the bay depend upon the local climate. The climate of Hudson Bay is more extreme than that of Hudson Strait which is affected by moderating effects of the Atlantic Ocean. It is probable, therefore, that maximum ice thicknesses are slightly greater in Hudson Bay than Hudson Strait.

The sea ice is different from fresh water ice. During the formation of sea ice, some of the brine becomes trapped between the ice crystals so that first year sea ice is generally weaker than fresh water ice. It also becomes rotten and melts more quickly during breakup.

Ice in Hudson Bay consists almost entirely of first year winter ice. Very rarely will polar ice from Foxe Basin drift into the northeast corner of the bay. Ice in Hudson Strait is predominately first year winter ice. Some polar ice may enter from Davis Strait at the eastern end and from Foxe Channel at the western end but the proportion of polar ice in any area is usually quite small. The growth of ice in both the bay and the strait usually begins early in November but the shipping lane generally remains open until the second week in November. The typical pattern of the growth of ice for the years

1963-1967 inclusive is shown in Figure A.5, Volume II.

The ice cover grows rapidly during late November and early December and there is probably an effective coverage of winter ice over the whole of the bay and the strait by the end of December. The maximum thickness of about five feet is reached sometime in May as shown in Figure A.4. It must be emphasized that the ice is seldom in the form of a continuous sheet over large areas because it is constantly being broken into floes of various sizes by the action of winds, waves and currents. Except for the fast ice fixed to the shores, the ice is constantly moving and there are always leads and weaknesses in the ice which can be exploited by icebreakers. The effect of strong winds causes tremendous pressures in the ice fields which result in extensive ridging and rafting. By the end of winter, approximately one third of the ice is ridged or rafted. Thawing and breakup begins early in May when ice concentrations less than 9/10's are first observed. Significant areas of open water and puddles on the ice appear by the end of May. Prevailing winds are generally from a northerly direction during the breakup period so that the earliest large areas of open water usually appear on the north side of the bay and the north side of the strait. The general pattern of final breakup during the years 1963-1967 is shown in Figure A.6 , Volume II.

For the purpose of deciding to what extent the shipping season might be lengthened, it is assumed that the problem of river slush ice discussed below can be overcome.

It is desirable to consider ships and their capabilities under the following categories;

1. unassisted, unstrengthened merchant vessels,

2. unstrengthened merchant vessels with icebreaker assistance;

3. unassisted merchant vessels with bow strengthening (Lloyd's ice class 3 or equivalent),

4. merchant vessels with bow strengthening and with icebreaker assistance,

5. unassisted merchant vessels with full strengthening (Lloyd's class 1 or equivalent),

6. merchant vessels with full strengthening and with icebreaker assistance, and

7. merchant vessels with full strengthening and possible special hull configurations.[1]

The conclusions based on a careful study of ice conditions and the capabilities of existing icebreakers and merchant vessels are summarized in Table A.5, Volume II, and shown graphically in Figure 9. It must be emphasized, however, that the periods indicated in Figure 9 are only a guide as to what is likely to be technically possible and it should not be assumed that such periods will be economically feasible. It should also be realized that there are a number of other important factors such as the size and power of the vessel, whether laden or light, and the skill and experience of the ship's master in ice infested waters.

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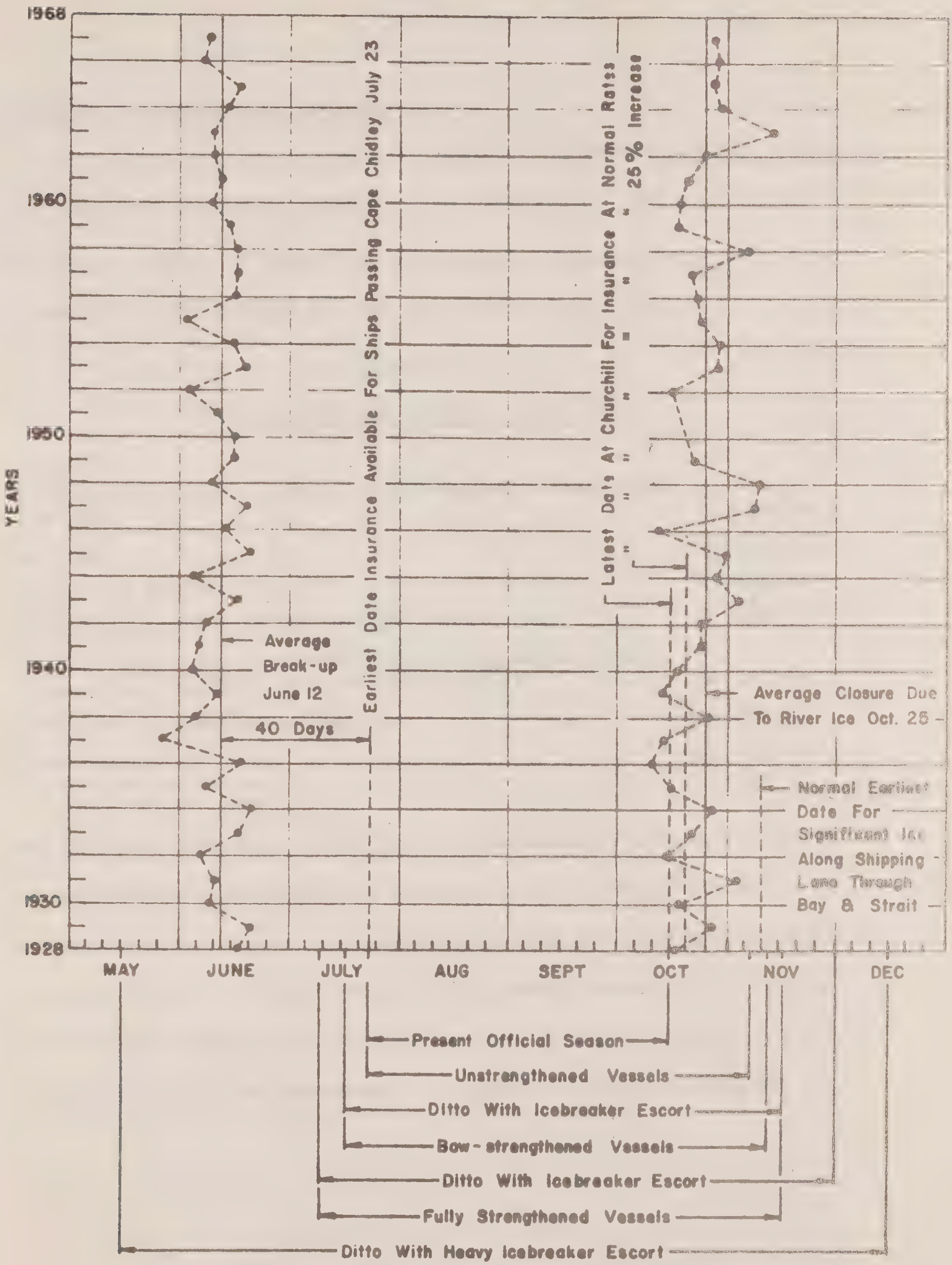
[1]The capabilities of vessels of the above categories are discussed in detail in Appendix A, Volume II.

HARBOUR BREAK-UP AND CLOSING DATES



POSSIBLE EXTENDED SHIPPING SEASON

(See Appendix A)

FIGURE 9

Problem of Slush Ice in the Harbour

This problem and various possible schemes for its solution are discussed in detail in Appendix B, Volume II. The problem is also dealt with in a report by the National Research Council.[2] Estimated costs of various schemes are shown in Table 40.

TABLE 40

ALTERNATIVE SOLUTIONS - SLUSH ICE

New channel to alter current distribution as suggested by NRC	$6,020,000
Ice Boom	$1,820,000
Deflecting groin	$1,900,000
Deflecting groin with new channel down stream	$4,600,000
Complete protection of wharf and turning basin with concrete or timber cribs or S.S.P. cells	$2,430,000
Diversion of river above harbour	$10,700,000
Tidal Barrier	$2,930,000

The consiceration of a scheme for eliminating or reducing the slush ice problem is confused by the present construction of works by Manitoba Hydro to divert Churchill River from Southern Indian Lake into the Nelson River. This diversion will greatly reduce the river flow entering the estuary and is likely to have a marked effect on the quantity of slush ice generated. It seems sensible, therefore, to

[2]"Feasibility of Extending Navigation Season at Churchill Harbour", National Research Council - December 1966.

postpone any major expenditure until the effect of the Manitoba Hydro diversion can be properly assessed after it comes into operation in 1973. If it is found that slush ice remains a problem after that date, the construction of a simple tidal barrier is recommended at an estimated cost of about $2,930,000.[3]

This would virtually eliminate the strong tidal current along the face of the wharf so that any remaining slush ice would not be a problem. It would have the further advantage of reducing currents in the harbour entrance to negligible proportions. In the event of the need for an extension of the shipping season beyond the slush ice phase, the elimination of strong currents would also simplify dealing with sheet ice in the harbour by means of icebreaker, compressed air systems or submersible pumps.

If, at some later date, access should be required to the west shore, the tidal barrier could be enlarged into a diversion causeway and a diversion channel could be excavated.[4]

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[3] Details of the recommended tidal barrier are discussed in Appendix B, Volume II.

[4] See Appendix B, Volume II for details.

CHAPTER 13

REDUCING NAVIGATION HAZARDS AND DELAYS

The following is a discussion of the extent to which the navigation hazards and delays outlined in Chapters 10 and 11 might be reduced.

Icebergs and Growlers

Past records have shown that icebergs and growlers are not a serious hazard if a proper lookout is kept by all vessels passing through the eastern part of Hudson Strait. There is no way of reducing the number of icebergs or growlers present in the strait but it would be reasonable to expect that the hazard will be reduced still further as the navigation aids contine to improve. Most of the vessels now using the Hudson Bay route are unstrengthened and the risk of serious damage will also be reduced if more vessels are, in future, strengthened for navigation in ice.

Tidal Currents at Churchill

The strong tidal currents in the harbour entrance and along the face of the wharf could be eliminated by a tidal barrier.[1] The estimated cost for such a tidal barrier is $2,930,000. If total annual charges on capital costs are assumed to be 7½ per cent, the annual cost of the barrier would be approximately $220,000.[2] If one assumes further, that the cost of each day's delay to an average merchant vessel is about $3,000, the tidal barrier would be justified if it saved a

[1] See Chapter 11 and Appendix B, Volume II.

[2] This annual cost assumes an annual interest rate of 6 per cent, an amortigation period of 50 years serviced at an annual charge of .41 per cent, and an annual maintenance charge of 1.09 per cent.

total of approximately 74 days delay to vessels entering or leaving the harbour. On the basis of these figures the tidal barrier would not appear to be justified at the present time for the sole purpose of reducing tidal currents. But it might well be justified for the dual purpose of reducing currents and solving the slush ice problem, if this problem is not solved from 1973 onwards by the works of Manitoba Hydro.

In addition to the above, the avoidance of any delays caused by strong tidal currents would ensure greater continuity in the loading of grain and, hence, increase the annual throughput of the terminal facilities, within the limits imposed by the grain cleaning equipment.

Strong Winds at Churchill

The main effect of strong winds is the delay caused by the inability of pilots to board vessels in rough conditions outside the harbour. There is nothing that can be done about the winds themselves and the only two solutions are to find better ways for the pilots to board vessels, or, to eliminate the need for pilots.

It is probable that special pilot boats would make it easier for pilots to board vessels than the use of the smaller of two tug boats as at present. The use of a helicopter has been suggested, but this would also be affected at times by bad weather and would be suitable only for those vessels which could arrange to provide a suitable landing pad.

The most hopeful way to reduce delays due to strong winds is to eliminate the need for pilots on board vessels entering or leaving Churchill harbour. The present need stems from a combination of an awkward entrance and strong tidal currents. The elimination of strong tidal currents as discussed earlier would make it easier for vessels to negotiate the changes of direction through the harbour entrance. With land based radar, associated computer, radio-telephone communication and, possibly conventional television, it should be entirely practical for vessels to be guided in and out of the harbours from a control room on shore. This question of future aids to pilotage is discussed in a recent publication.[3]

Depth in Churchill Harbour

The depth in Churchill harbour and its approaches is limited to a large degree by what further dredging would be economically feasible. Unfortunately, it is not at present possible to make a reliable estimate of the cost of further dredging because there is insufficient information about the extent of rock which may be encountered. The present depth restricts the departure of

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[3]"Oceanborne Shipping: Demand and Technology Forecast" Part 1. Litton Systems, Inc.; June 1968.

the larger laden vessels to a period of two or three hours either side of high tide. Strong currents on spring tides may further restrict the departure to the final two or three hours of the flood tide or to slack water at high tide. Further dredging of the channel both outside and inside the harbour would give greater flexibility in the timing of the departure of large vessels.

The volume of dredging required is not large for a minimum depth of 30 feet over a width of 600 feet -- about 250,000 cubic yards outside the harbour and about 450,000 cubic yards inside the harbour. The cost would be high, however, because of the shallow depth of cut, strong currents in the harbour and rough weather outside. The total cost might be as much as $2,000,000.

The above comments refer essentially to the existing facilities with the existing dredged depth at the berths.

The question of providing facilities with substantially greater depth is discussed in the following chapter in relation to possible future use of large special purpose bulk freighters.

CHAPTER 14

NEW METHODS OF SHIPMENT

Thompson-Churchill Highway

The economic justification of a highway connection between Thompson and Churchill would depend upon the savings in transportation costs it would produce. In an evaluation of proposed highways in northern Manitoba prepared in 1962 for the Committee on Manitoba's Economic Future, it was determined that the above highway could not be justified either in terms of cost savings or as a device to open up new territory. In view of the existing rail line, the proposed highway connection would essentially be a substitute transport system which would have to compete with the rail line for commodity traffic.

Based on commodity traffic which existed when the above evaluation was prepared it was considered that such a highway could not be justified in economic terms. Based on assessment of present commodity traffic which has not changed significantly since 1962, it indicates that a highway connection between Thompson and Churchill at the present time or during the projection period, could not be justified in economic terms.

Grain Trans-shipment Ports

The feasibility of operating a grain shuttle service via Churchill to a deepwater trans-shipment point has been considered. Possible locations for a grain trans-shipment port would depend upon the proximity of the location to the Western European market.

Logical locations for such a trans-shipment port might be Godthaab, Greenland, Reykjavik, Iceland or St. Johns, Newfoundland. Substantial investment would be required for port and storage facilities at the trans-shipment point. Though this type of solution for increasing grain traffic through Churchill is technically possible, the magnitude of movement required for sufficient returns to be gained on the investment required would make this type of solution not economically feasible.

Air Cushion Vehicles

It is attractive, in theory, to envision large amphibious cargo-carrying air cushion vehicles (A.C.V.'s) as the answer to an all-year-round service on the Hudson Bay Route. However, such A.C.V.'s would have to be very large for two reasons. Firstly, to obtain a reasonably smooth and safe ride over the Atlantic waves and the intensely ridged winter ice of Hudson Strait and Bay. And, secondly because it is only with the development of very large A.C.V.'s that there would be any hope of competing with other forms of transportation for transatlantic trade.

Unfortunately, unless some completely new form of propulsion can be devised, it seems that there is a severe practical limitation to the size of truly amphibious A.C.V.'s. This question of size related to propulsion was discussed at a recent meeting of The Institute of Marine Engineers.[1] Air jet propulsion is only efficient at very high

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[1] Transactions of the Institute of Marine Engineers, March 1968, Volume 80 No. 3 pages 65-81.

speeds and, for speeds of about 80 m.p.h., large air propellers are the most efficient form of propulsion. As a result the practical size of an amphibious A.C.V. is limited by the number, size and tip speed of the air propellers that can be fitted. The limit with present technology appears to be only a few times bigger than the SR. N4 Hovercraft which has an all up weight of 160 tons. It is possible, however, that the future development of propeller blades made of carbon fibre reinforced plastic would make it feasible to produce a thrust ten times that of the SR. N4 but, even so, the all up weight of the craft would still be only about 2,000 tons, -- very modest compared with conventional ships.

A recent development of the A.C.V. is the "Hovermarine" which has solid side walls and water propellers. With propulsion by means of water propellers, or the future alternative of water jets, there is no obvious limit to the size of the vessel; but it is no longer amphibious and would not be able to travel over ice.

The conclusion is, therefore, that, in the absence of some unforseen breakthrough, the A.C.V. is not going to displace or compete with conventional shipping for carrying cargo on the Hudson Bay Route.

This does not mean, however, that the A.C.V. may not have an important role in an overall transportation system based on Churchill. The amphibious A.C.V. clearly has potential for overland transportation in northern Canada. Its cost is high but, then, so is any other form of transportation in the north.

The most likely role for A.C.V's based on Churchill would be for prospecting, surveying, drilling, bringing in construction equipment and

supplying coastal settlements in the Hudson Bay area. It is not expected that A.C.V.'s will carry major quantities of bulk commodities for which roads or railways would be constructed.

The use of A.C.V.'s in northern Canada is the subject of a separate study through the Agencies of the Canadian Transport Commission and the National Research Council. Pending the completion of this study it seems probable that A.C.V.'s will not have a major effect on the trade through Churchill or the facilities required.

Details of some presently available A.C.V.'s are shown in Table 41.

TABLE 41

DETAILS OF SOME EXISTING AIR CUSHION VEHICLES

Craft designation	SR. N6	SR. N4	HM-2
Date of launch	May/65	Oct./67	
Length, overall, feet	48	130	51
Beam, overall, feet	23	77	20
Cushion area, square feet	740	7,342	
Draught, hovering, feet	0	0	2.25
Draught, floating, feet	3.5	6.75	4.84
Normal A.U.W., long tons	9	165	16
Normal capacity, passengers	38	609 or 174 + 34 cars	60
Alternative freight, long tons	3	50	5
Service speed, knots	50	61	35
lift engine power, h.p.) Propulsion engine) power, h.p.)	900	4x3400	180 2x320
Endurance at maximum power, hours	3.6	3	4
Range, nautical miles (calm water)	200	175	140
Approximate cost with spares, ($Can.)	$450,000	$5,600,000	

Cargo Submarines

The typical naval submarine is a comparatively small vessel with a submerged displacement of about 3,000 tons. A cargo submarine must

be a much larger vessel if it is to carry a reasonable payload and be competitive with a bulk surface ship. A comprehensive design study[2] showed clearly that for economic advantage a nuclear cargo submarine had to be very large and fast. The typical relationship of cost to speed and size in comparison with a surface vessel is shown in Figure 10. The relationship of cargo carrying capacity to displacement is shown in Figure 10. Clearly, cargo submarines of an economical size will be limited to ports or terminal facilities where there is a substantial depth of water.

In the design study referred to above the size of the submarine was limited to 50,000 tons deadweight by the depth of water in the fitting out basins then (1959) in existence in the United Kingdom. Such a submarine would have the following characteristics:

Displacement, submerged	50,000 tons
Cargo capacity (heavy density material)	28,000 tons dwt.
Hull diameter	72 feet
Loaded Surface Draft	59 feet
Light Draft	35 feet
Shaft Horsepower	50,000
Speed, submerged	25 knots

In a study carried out about the same time for a submarine tanker the Japanese[3] selected a submarine of very similar size having 54,500 tons displacement, 30,000 tons deadweight carrying capacity and a submerged speed of 24 knots.

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[2] Woodward, E.A. "Freighter Submarines". 3rd National Northern Development Conference, Edmonton 1964.

[3] Shigemitser, M. "Nuclear Powered Submarine Tanker". Second United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva 1958 - Paper A/Conference 15/P/1320.

NUCLEAR POWERED CARGO SUBMARINES

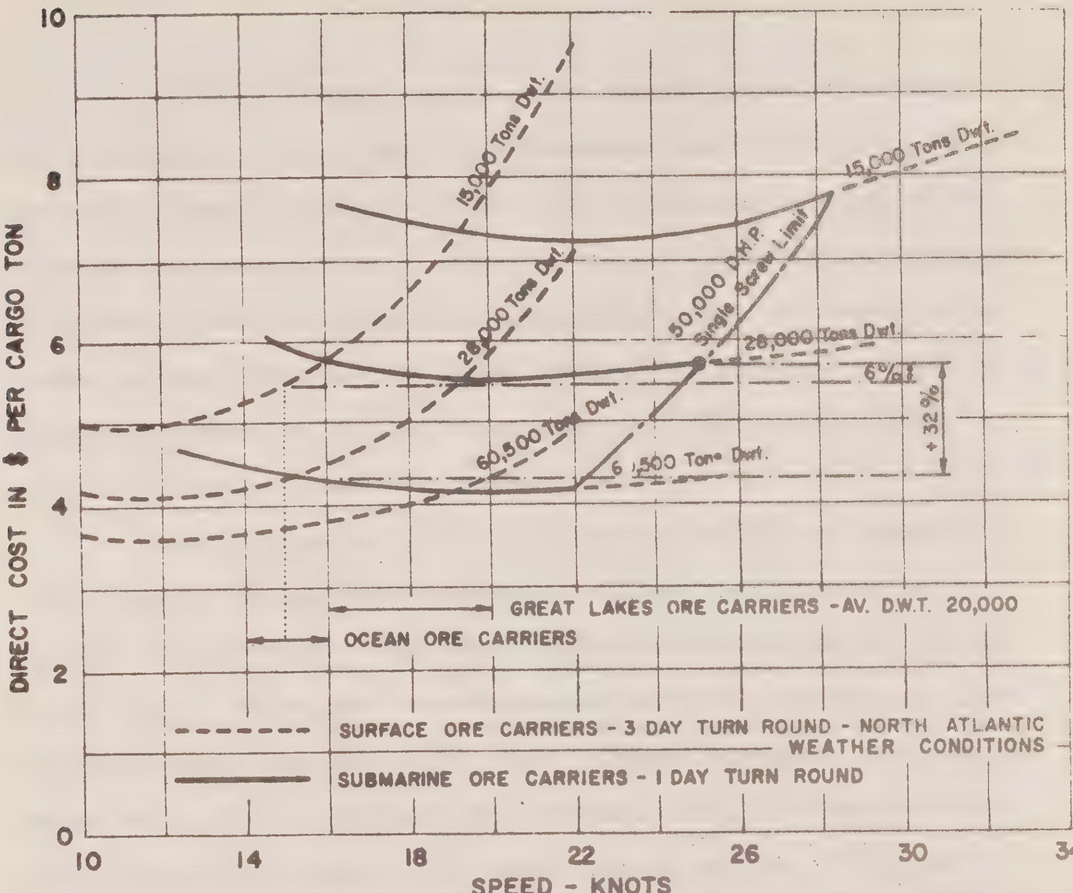
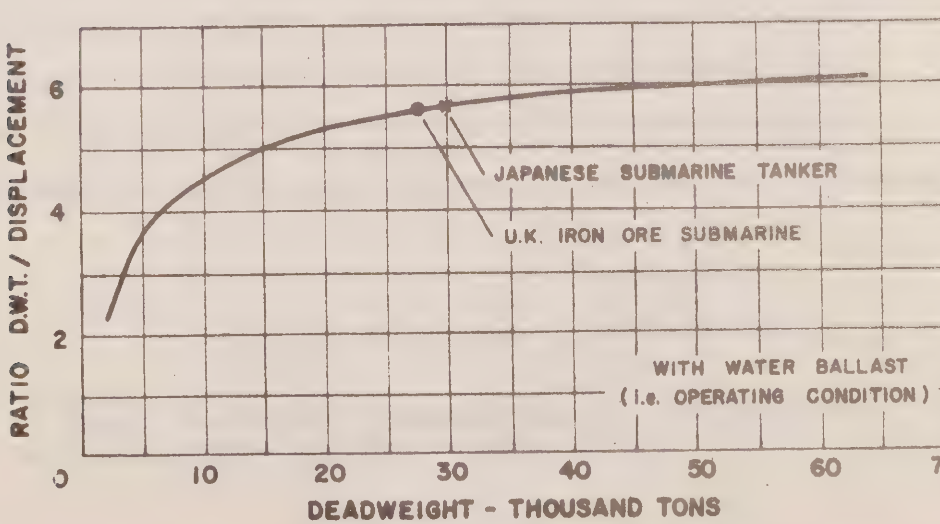


FIGURE 10a



SOURCE: "FREIGHTER SUBMARINES" 3rd. NAT. NORTHERN DEVELOPMENT CONF. EDMONTON OCT. 1964

FIGURE 10b

Submarine tankers have also been studied in the United States.[4] The study covered vessels ranging in deadweight from 20,000 to 40,000 tons and in speed from 20 to 40 knots. One of the main features of this study was the investigation of submarine tankers of rectangular form which would have a greatly reduced draft, permitting access to harbours in the loaded surface condition. The study confirmed the technical feasibility of rectangular submarines for liquids and indicated that the cost would be similar to that for circular submarines.

A cargo submarine of circular form and 28,000 tons deadweight would require a minimum berthing depth of 62 feet when surfaced and about 130 feet when submerged The normal cruising depth would be between 180 and 300 feet at which depth wave resistance would be negligible and clearance below field ice and growlers ample. Generally speaking, the required depths are available in Hudson Strait and Hudson Bay, but the submarine would have to surface some twenty miles from the Harbour of Churchill. It has been suggested that a floating berth could be constructed and wheat or other bulk materials transported over the ice. This would be a precarious and unreliable operation. The proper solution for loading an underice cargo submarine would be a submerged terminal fed by pipelines or a conveyor tunnel, depending on the commodity. Approximate

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[4] Russo, Vitol et al. "Submarine Tankers". The Society of Naval Architects & Marine Engineers, November, 1960.

cost of such a facility at Churchill would be:

For Oil or Piped Materials	
Terminal and navigation aids	$9,200,000
24" pipeline, 20 miles long	4,600,000
Total	$13,800,000

For Wheat or Belt Conveyed Material	
Terminal and navigation aids	$11,500,000
Tunnel, 20 miles long	23,000,000
Conveyor, 20 miles long	4,500,000
Total	$39,000,000

Clearly the cost of the tunnelled conveyor system is very high and could be justified only for a very large movement of wheat or other solids through Churchill by submarine on an all-year-round basis. It would also be necessary to analyze for a particular movement the overall economics of different sizes of submarines and corresponding terminal costs.

Although the cost of an underwater pipeline is much less than a tunnel and conveyor, it is open to question whether Churchill would be the right location for a terminal for oil or commodities not dependent on the railway. Assuming a new overland pipeline has to be built, consideration should be given to terminating it at Rankin Inlet or Chesterfield Inlet where deep water is much closer to shore than at Churchill.

Containerization

The main advantages to be gained from the use of containers are greatly reduced handling costs and more efficient use of ships due to more rapid turnround in port. Subsidiary advantages are reduced

damage and pilferage of certain types of cargo.

For shippers of goods to be attracted to the use of containers, there must generally be a good frequency and regularity of service combined with competitive rates. This means that for a container operation to be successful, there must be an adequate potential tonnage of containerisable cargo to justify a regular service.

The competitive rate must, of course, apply to the complete journey from factory to consignee. In the case of Churchill, this would mean a movement from somewhere in Europe to Western Canada. If present rail rates for general cargo were to continue to rule, it could be argued that the shorter rail distance from Churchill to Western Canada should make the shipping of general cargo via Churchill more economical. However, one marked feature of containerization is the possibility for greatly reduced rail costs, due to reduced handling costs and the more frequent use of less expensive rolling stock. This means that with the use of containers the longer rail haul from Eastern ports such as Montreal, Quebec or Halifax, will become more competitive with Churchill than they are at present. This fact combined with the disadvantage of the short season at Churchill, makes it unlikely that a full container service could operate economically to Churchill in the foreseeable future.

This does not mean, however, that small consignments of goods will not go to Churchill in containers on conventional vessels if suitable

lifting arrangements are available in the port of origin, as well as at Churchill. Some cargoes such as whisky and beer which already pass through Churchill would be eminently suitable for containers, and would greatly speed up the discharge of vessels and reduce delay before grain can be loaded for export. Consideration should therefore be given to the provision at Churchill of a mobile crane or suitable device for economically handling containers in small quantities.

Special Purpose Bulk Surface Freighters

Special fully strengthened bulk freighters for operation to Churchill might be constructed to carry commodities such as grain, oil, potash, pulpwood or sulpher throughout a period considerably longer than the present shipping season.

It is now well established that within the limits imposed by the terminal ports there are substantial economies in using the largest possible bulk freighters. This is even more desirable in the case of ice-strengthened vessels where the extra costs of the increased power and strengthening and the reduction in payload become proportionately less per ton of cargo as the size of the vessel increases.

The Port of Churchill has definite limits to the accommodation of large vessels. Records indicate that the greatest laden draft of a vessel leaving Churchill has been about 34 feet. The present berths are dredged to 32 feet and the approach channel has a minimum depth of about 24 feet below chart datum. With a mean tide of 8 feet above chart datum, it is clearly not practicable, as a general

rule, to accommodate vessels with a laden draft of more than about 34 feet, even if completion of loading and departure is timed to suit the tide.

Deepening of the approach channel to, say, 30 feet, would give greater flexibility in timing the departure of large vessles, but would not increase the laden draft of a vessel significantly because this is governed mainly by the quantity of bulk material that can be loaded between low tide and the time of departure near high tide.

There is little doubt that the substantial economies derived from the use of large dry-bulk vessels will require greater depth at Churchill if the Port is to remain competitive with St. Lawrence Gulf grain terminals, such as those at Baie Comeau and Port Cartier. The extent to which it will be economically desirable to increase the depth at Churchill will depend on the in store price of grain, a detailed economic analysis following further sub-surface investigations, and more accurate estimates of the many engineering alternatives. However, the following possibilities and approximate costs are summarized for initial guidance:

- The berth depth immediately in front of the existing grain loading facilities cannot be deepened significantly beyond the present depth of 32 feet without endangering the stability of the timber cribs of which the wharf is constructed. However, less dependence on the tide and greater flexibility in the timing of the departure of vessels would be obtained by deepening the approach channels to 30 feet at an estimated cost of about $2 million. With this

deepening, and by still making some use of the tide, vessels might be loaded at the existing facilities to a maximum draft of 35 feet, corresponding to a deadweight of about 33,000 long tons.

- A deep berth could be dredged in front of the existing grain loading facilities provided that the deepening was sufficiently far from the face of the existing wharf so as not to endanger its stability.

Subject to a detailed engineering study, it would seem likely to be possible to dredge deep berths up to 50 feet at a safe distance from the face of the existing wharf, and to secure vessels at the required distance by one or other of the following methods:

1) Timber cribs with a stepped bottom profile placed at intervals in front of the existing wharf,
2) Sheet pile cells filled with gravel at intervals in front of existing wharf,
3) Strong fender systems cantilevered like out-riggers from the existing wharf,
4) As above, but with spud legs if the distance from the face is too great for cantilevers,
5) Floating fenders or pontoons, spaced as required along the face of the existing wharf.

Which of the above methods would be the most economical answer could only be determined by a detailed engineering study taking into account such factors as: foundation conditions, ice problems, depth

of berth required and the condition of the existing structures. However, a preliminary first estimate would indicate that arrangements might be made for a double berth facility in front of the existing wharf at the following cost:

	Double Berth Facility 40-foot depth	Double Berth Facility 50-foot depth
Fixed or Floating Spacing Fenders	$ 600,000	$ 600,000
Dredging Berth	375,000	1,060,000
Dredging Turning Basin to 40 feet	1,750,000	1,750,000
Dredging Channels to 40 feet	5,490,000	5,490,000
Extending Grain Spouts, etc. and Contingencies	1,250,000	1,250,000
TOTAL	$ 9,465,000	$10,150,000

All the above estimates assume a short new approach channel on a new alignment outside the harbour as shown in Figure 11. If a long channel is dredged to 40 feet on the line of the present approach, the extra cost in all cases would be about $2,400,000.

The annual cost of carrying the investment at 7.5 per cent for a double berth facility with 50 foot depth in front the existing facility would be approximately $761 thousand. The annual investment on a per bushel basis for a throughput of 30 million bushels would amount to 2.5¢/bushel. On a throughput of 64 million bushels the annual cost of the investment per bushel would be reduced to 1.2¢/bushel.

- A new deep berth, served by a new grain gallery from the existing elevator, could be built to the north of the existing berths.

However, rock is suspected at a fairly high level in this area and excavating and dredging might be very expensive. Assuming 25 per cent rock, the cost of a new single berth facility with a depth of 40 feet, including berth, dredging and new grain gallery would be about $15,300,000. A similar facility with a berth depth of 50 feet, but with turning basin and approach channels of 40 feet depth would be about $15,700,000.

- A new deep berth could be built on the west side of the harbour to make use of existing deep water as shown in Figure 11. A single berth facility with a depth of 40 feet would cost in total about $31,600,000, made up as follows:

(a)	River Diversion	$12,700,000
(b)	New wharf dredging and access road	5,900,000
(c)	5 million bushel grain elevator without cleaning facilities	11,250,000
(d)	Railway or conveyor system for conveying grain	1,750,000
	TOTAL	$31,600,000

A similar facility with a depth at the berth of 50 feet would cost very little extra, at a total of about $31,775,000. A two berth facility with a depth of 50 feet at the berth would cost about $33,275,000.

The annual cost of carrying the investment for a two berth facility of 50 foot depth on the west side of the harbour at 7.5 per cent would be approximately $2.5 million. At a throughput of 30

million bushels the annual interest cost per bushel would be 8.3¢. If the most probable export potential of 64 million bushels from the hinterland were realized the annual cost of the investment per bushel would be reduced to 3.9¢.

The alternatives for providing facilities with greater depth at Churchill are so numerous and so complex that the most economical solution and its justification in terms of benefits can only be determined by a detailed study outside the scope of the present report. However, the above figures indicate that the most economical solution is likely to be found in some method of deepening, and berthing vessels a safe distance in front of the existing wharf.

Benefits of Special Purpose Bulk Surface Freighters

The benefit of a possible deeper water bulk terminal at the Port of Churchill can be assessed by considering the saving per bushel of grain in the transatlantic shipping cost resulting from the use of larger vessels. At the same time such an evaluation indicates the competitive advantage of St. Lawrence Gulf ports which now can accommodate larger vessels than presently is possible at Churchill.

Table 42 shows the cost per bushel of transporting grain across the Atlantic in modern dry bulk ships with an assumed speed of 16 knots. Costs are shown for two possible routes:

a. Rotterdam - Churchill

b. Rotterdam - St. Lawrence Gulf where the port might be either Baie Comeau or Port Cartier.

It can be seen from this table that the provision at Churchill of facilities for vessels up to a 40 foot draft would permit a saving in transatlantic freight costs of about 6 cents as compared with vessels having a draft of only 30 feet. It can also be seen that vessels with a draft of 50 feet, loading grain at a St. Lawrence Gulf port, would have an overall advantage of about 8 cents over vessels with a draft of 30 feet loading grain at Churchill.

It will also be noted that the cost per bushel for these larger vessels is very much less than the current typical rate shown in Table 2 of Chapter 3, but that exterpolation of the Churchill-Rotterdam curve corresponds very closely to this rate at the 22 foot draft level.

The data included in Table 42 shows how cost factors are tending to operate against the smaller vessel and how important harbour depth is becoming. Recent grain fixtures announced in Lloyd's List Shipping and Gazette confirm that much lower freight rates are now being charged for the use of large bulk carriers. Rates as low as $2.75 per ton have been quoted for a vessel carrying 40,000 tons of grain from Port Cartier to Rotterdam.

The inference is clear that in the absence of additional dredging at Churchill, the in store price of grain will almost certainly have to be adjusted below its present level in order to remain competitive with the St. Lawrence Gulf ports.

TABLE 42

RELATIONSHIP OF VESSEL DRAFT AND SIZE TO GRAIN OCEAN SHIPPING COSTS

Laden Draft	feet	30	35	40	45	50
Deadweight	long tons	18,000	33,000	52,500	77,000	105,000
Length Overall	feet	505	615	720	800	835
Capacity	1000 cu. ft.	840	1,470	2,290	3,280	4,500
Grain Cargo	1000 Bushels	660	1,150	1,790	2,560	3,510
Cost to Owner	$1000	4,100	6,300	8,500	10,500	12,000
Interest at 7% & Amortization over 20 yrs. (9.44%)	$1000	386	595	802	990	1,130
Annual Running Costs	$1000	458	576	606	625	660
Total Annual Costs	$1000	844	1,171	1,408	1,615	1,790
Profit - 5% on Capital	$1000	205	315	425	525	600
Total Annual Cost & Profit	$1000	1,049	1,486	1,833	2,140	2,390
Charge/day in Port	$	3,330	4,720	5,830	6,800	7,600
Fuel cost/day	$	800	1,140	1,450	1,690	1,930
Charge/day at Sea	$	4,130	5,860	7,280	8,490	9,530

Approximate Round Trip Costs

A. Rotterdam - Churchill (4000 miles)

Days loading & unloading		4	5	6	8	10
Cost in Port	$	13,300	23,600	35,000	54,400	76,000
Cost at Sea (18 days)	$	74,300	105,500	131,200	153,000	171,500
Total Cost	$	87,600	129,100	166,200	207,400	247,500
Cost/bushel	¢	13.3	11.2	9.3	8.1	7.05

Approximate Round Trip Costs

B. Rotterdam - St. Lawrence Gulf (3200 miles)

Days loading & unloading		3	4	5	7	9
Cost in Port	$	10,000	18,900	29,150	47,600	68,400
Cost at Sea (15 days)	$	62,000	88,000	109,200	127,400	143,000
Total Cost	$	72,000	106,900	138,350	175,000	211,400
Cost/bushel	¢	10.9	9.2	7.7	6.8	6.0
Typical Port Charges (Note 6)		4.0	3.7	3.2	3.1	3.0

TABLE 42 - cont'd

SUMMARY OF COSTS						
A. Rotterdam-Churchill	¢	17.3	14.9	12.5	11.2	10.05
B. Rotterdam - St. Lawrence Gulf	¢	14.9	12.9	10.9	9.9	9.0

Source: Gibb, Albery Pullerits & Dickson

Note:
1. Ship Capital Costs approximately 40 per cent above 1967 Japanese costs
2. Operating Costs as for European Countries
3. Efficient loading and unloading facilities both ends assumed
4. 315 working days/year corresponding to 15 days maintenance and 35 days idle
5. Ship travels in ballast east to west
6. Typical port charges include stevedoring, harbour dues, dockage, wharfage, pilot, tugs, sick mariners dues, boatmen, port warden, health and agency fee.

GRAIN OCEAN SHIPPING COSTS AND THEIR VARIATION WITH VESSEL DRAFT

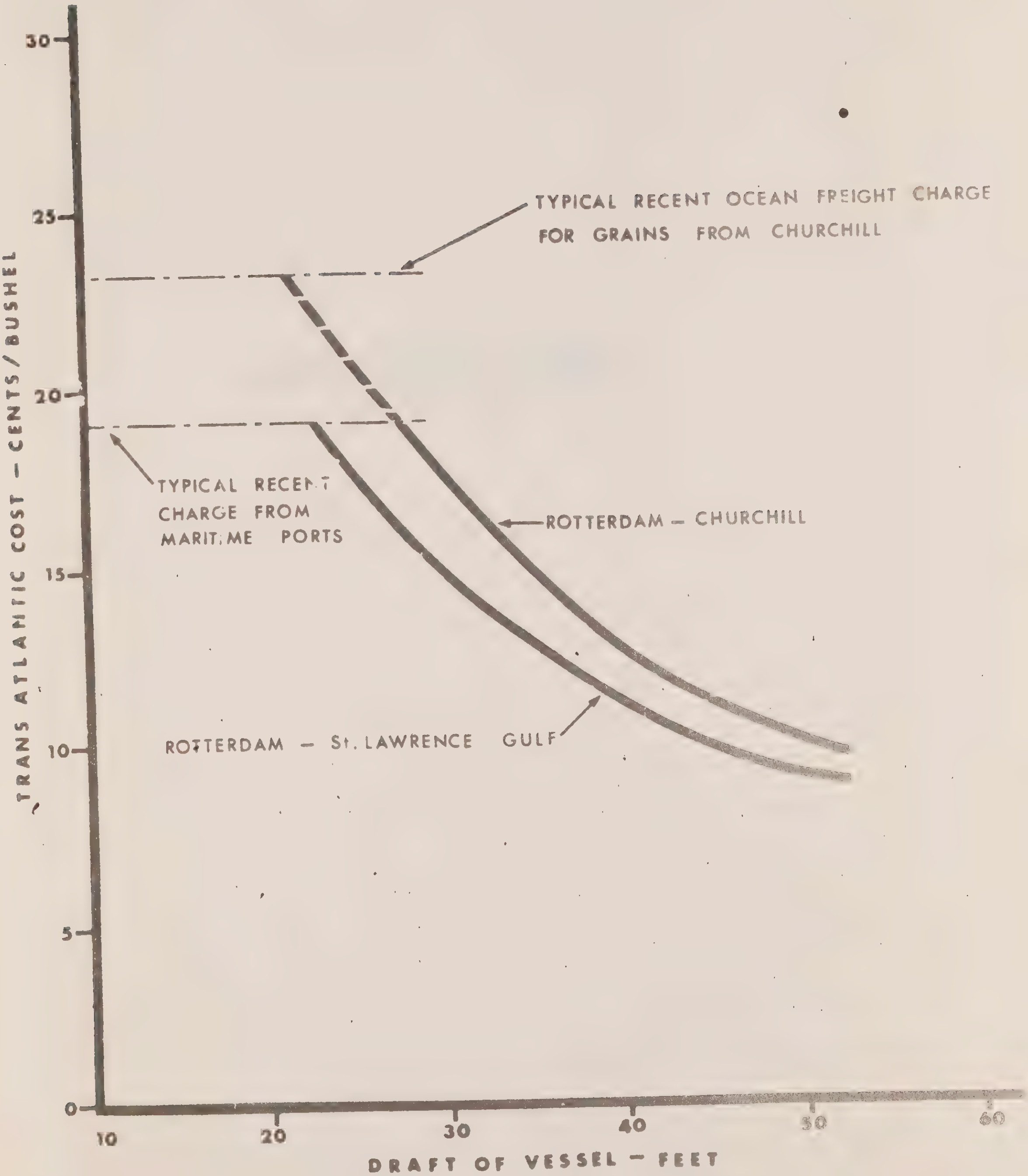

FIGURE 12

PART IV

PRACTICAL PROGRAMME FOR INCREASING PORT TRAFFIC

CHAPTER 15

A COMPARISON OF ALTERNATIVE DEVELOPMENT PROGRAMMES

Extension of the Navigation Season

It is clear that the potential traffic through the Port of Churchill in the foreseeable future will be restricted to conventional regular and strengthened surface vessels and consequently will be dependent to a considerable extent on the length of the navigation or shipping season. It is necessary, therefore, to make a broad realistic assessment of the potential length of the shipping season which might be reasonable from an economic point of view before discussing the adequacy of the existing facilities at the Port or the measures which might be taken to provide for the potential traffic.

The maximum navigation period which can be considered is the possibility of all-year-round shipping. This would require:

a. Three large icebreakers to escort a continuous flow of vessels into Churchill at about 4 day intervals and at a reasonable speed of about 7 knots through the ice.

b. Merchant vessels fully strengthened to Lloyd's ice class 1*.

c. Special heating and other arrangements at Churchill to make working throughout the winter practicable.

The size of icebreaker is difficult to assess because there is no past experience from which to judge the effect on shipping lanes of repeated passage at approximately 4 day intervals and the extent to which shipping lanes once formed will make subsequent passage easier.

It is probable, however, that icebreakers of at least 25,000 shaft h.p. costing about $20,000,000 each would be necessary. Assuming interest and depreciation at a probable rate of about 10 per cent, annual charges on this capital would be $2,000,000 which when added to running costs of about $1,000,000, would result in total annual costs of $3,000,000 per vessel. Assuming year-round use for the icebreakers, the cost attributable to 12 days escort of one vessel both ways along the Hudson Bay Route would be approximately $100,000.

Ice strengthened vessels using Churchill on a year-round basis would almost certainly be as large as the port could accommodate; probably having a maximum laden draft of 34 feet, a deadweight of 30,000 long tons and carrying capacity of about 1,150,000 bushels of grain. Such a vessel might cost about $6,600,000, of which about 9 per cent would be the cost of strengthening and additions to Lloyd's ice class 1* specifications. Assuming that interest, depreciation and profit would be at an annual rate of 15 per cent for such commercial vessels and adding typical running costs, the total annual costs would be about $1,700,000. Assuming that the vessel is used for 315 days per year, the cost per day would be $5,600 and the total additional cost attributable to the six extra days required for navigation through ice at only 7 knots would be $33,700.

The extra cost per vessel per trip of maintaining a shipping service to Churchill throughout the winter may be summarized as follows:

Icebreakers, capital charges	$67,000
Icebreakers, running costs	33,000
Strengthening of vessel	6,500
6 days extra travel time	33,700
Extra costs at Churchill	1,200
	$141,400

This is equivalent to 12.3 cents per bushel and it is clear, therefore, that all-year-round navigation to Churchill is not economically justifiable, even assuming that the additional costs are spread over the grain shipped during the entire year and not only for that which would be carried during the winter.

If a more limited shipping season of seven months from mid-May to mid-December is considered, it would be reasonable to assume that the existing icebreakers operated by the Department of Transport would be adequate and available after winter service in the St. Lawrence River and Gulf. The cost of icebreaker assistance on the Hudson Bay Route from mid-May to mid-July and from early November to mid-December would, therefore, consist of running costs only.

Assuming similar ice strengthened vessels as for year-round operation and a speed of 7 knots through ice, as in the case of year round navigation the extra cost per vessel per trip during the extended spring and fall periods indicated above would be:

Icebreakers, running costs	$33,000
Strengthening of vessel	8,400[1]
6 days extra travel time	33,700
	$75,100

[1] In the case of the seven month season it has been assumed that the per trip costs of strengthening of vessels is $1,900 more than similar costs for a vessel which would operate for twelve months. The reason for this additional cost is the fact that the vessel would operate for the remainder of the winter under largely ice free conditions on other routes where vessel strengthening would not be required. Consequently virtually all of the vessel strengthening costs have been applied to Churchill.

This is equivalent to 6.52 cents per bushel. If the icebreaker service were to be provided free, the extra cost to the shipping company would be 3.65 cents per bushel. This latter cost might be recoverable by the shipping company if the "in store" price of grain at Churchill could be reduced by an equivalent amount.

It is estimated that by 1985 the extension of the Port's navigation season to seven months would be costing more than two million dollars per year in additional shipping costs for grain alone. At this same time, maintaining year round navigation would cost more than eight million dollars per year in additional shipping costs for grain based upon the potential which can realistically be expected.[2] Furthermore, unless adequate incentives, possibly larger than discussed above, were to be provided as compensation for the increased transportation costs and the risk of ice operations at Churchill, shipping companies would be reluctant to operate in any concentrations of ice which reduce the speed of the vessel substantially below the normal cruising speed. This means, in effect, that even if icebreakers service was provided and the investment made to keep the harbour operative, even those vessels conforming to Lloyd's ice class 1 or 1* would be unlikely to operate on the Hudson Bay Route outside a season

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[2]These cost estimates are based on the export potential shown in Table 39, p. 113 and the costs of extending the navigation season in Appendix A, Volume II.

from early July to mid-November without substantially higher shipping rates than at present.

In Chapter 10 potential grain export forecasts were made for 1985 assuming that the Port would be open for two different periods of time. The two operating seasons for which the grain throughput was forecast are:

a. A port operating season of twelve months, and,

b. The port operating season extended from the present 82 days to 105 days. The grain throughput forecast for the 12 month port season totalled 1.6 million tons, equivalent to 64 million bushels. Grain exports in a 105 day port operating season, under present market conditions, could amount to 909 thousand tons or 36.4 million bushels.

If the port were to remain open all year, fully ice strengthened vessels with icebreaker assistance would be required and perhaps a tidal barrier would have to be constructed. The annualized cost of providing these requirements coupled with the cost of carrying the present investment at Churchill, related to the average bushel of throughput would be as follows:

Assuming All Year Operation	Bushels (millions)	Annual Average Cost Per Bushel (¢/bus.)
With fully strengthened vessels and St. Lawrence Icebreaker	64.0	19.0
With tidal barrier, fully strengthened vessels and St. Lawrence Icebreaker	64.0	19.3

If the Port were to remain open an additional 23 days in addition to the existing investment at the Port perhaps a tidal barrier would be required. The total annual cost of carrying this investment related to grain throughput for the 105 day port season would not require the inclusion of strengthened vessels or icebreakers. The average cost per bushel of throughput would be as follows:

Assuming 23 Day Extension	Bushels (millions)	Annual Average Cost Per Bushel (¢/Bus.)
Without tidal barrier	36.4	9.6
With tidal barrier	36.4	10.2

The present annual cost of the existing investment at Churchill related to an average throughput of 20 million bushels, representative of recent grain traffic, within an 82 day season is approximately 17.5¢ per bushel.[3]

It is concluded therefore that, unless special and completely uneconomic incentives are provided, the realistic potential shipping season at Churchill is and will remain somewhere between the present 82 days and 105 days[4]. It is, therefore, necessary to consider the

[3] This discussion of the per bushel cost of extending the navigation season is detailed in Appendix A, Volume II.

[4] The 105 day port operating season is based on a continuation the present date of opening of the Port on July 26 to November 7, the latest date at which ships could leave the Port and avoid winter ice on the Bay and Strait.

adequacy of the facilities at Churchill on the basis of the traffic projected for shipping seasons of these lengths.

Adequacy of Existing Transportation System

The adequacy of the existing transportation system to handle the potential commodities may conveniently be considered under the following three headings:

- Railway System
- Grain Handling Facilities
- Port and Shipping Facilities

Railway System

By far the greatest bulk of material to be handled by the railway in 1985 is grain. If this commodity can be handled with some capacity to spare, there should be no difficulty in handling the comparatively small tonnages of other materials, particularly if arrangements are made for storage or stockpiling so that at least a portion of these other materials may be conveyed during a period outside the normal shipping season.

At the present time during the shipping season the Canadian National Railways run one train per day to Churchill seven days a week. Each train consists of an average of 160 cars and is designed to synchronize with the handling capacity of the elevator at the Port. Trains of as many as 200 cars have been operated at times.

With mid train power it would be possible to operate trains of 300 cars with provision of some additional trackage at the end

terminals and the intermediate terminals of Gillam, Waboden, The Pas and Hudson Bay.

On main lines as many as 10 or 11 long trains are run in each direction every 24 hours and it would be possible to run a similar number on the Hudson Bay railroad if additional passing terminals were provided at suitable intervals.

The average load of grain per boxcar has been about 1,870 bushels. The ultimate capacity of the railway is, therefore, at least 1,870 x 300 x 10 x 82 = 460 million bushels of grain. This is many times the potential exports through Churchill and it is clear that the railway capacity is not and never will be a critical factor in the Ports future development.

Grain Handling Facilities

The existing grain handling facilities at the Port are described in Chapter 1 where the working capacity of the equipment is shown in bushels per hour. The official work period is one eight-hour shift six days a week but overtime is worked as necessary, particularly on the cleaning where 12 - 14 hours is commonly worked seven days a week. The ultimate capacity of the existing grain handling facilities obviously depends on the hours of work and the practicability of introducing more than one shift. The following indicates the maximum effective capacities for various methods of working for an 82 day shipping season.

Item	Effective Capacity in Millions of Bushels			
	6 days/week 8 hour/day	7 days/week 12 hour/day	7 days/week 16 hour/day	7 days/week 24 hour/day
Car dumpers	19.7	34.3	45.8	68.6
Receiving scales	20.2	35.4	47.2	70.8
Cleaning equipment	9.8	17.2	22.9	34.4
Shipping scales	29.2	51.1	68.2	102.2
Conveyor system	29.2	51.1	68.2	102.2

It can be seen from the above that, with the present high proportion of Number 1 and 2 Northern wheat which often requires cleaning two or three times, it is the cleaning equipment which is the bottle-neck. Assuming the same proportions of the various classes of grain and 5 million bushels of clean grain in store at the beginning of the season, the ultimate capacity of the present grain handling facilities would be about 39 million bushels assuming a 24 hour working day for 82 days.

Port and Shipping Facilities

a. General - The main wharf is capable of handling either four large vessels or five smaller vessels. At the north end of the wharf, at right angles to it, is a berth for coastal vessels. For the purpose of discussing the capability of the berthing facilities, the following assumptions have been made (see Figure 2)[5]:

[5]Figure 2 Chapter 1.

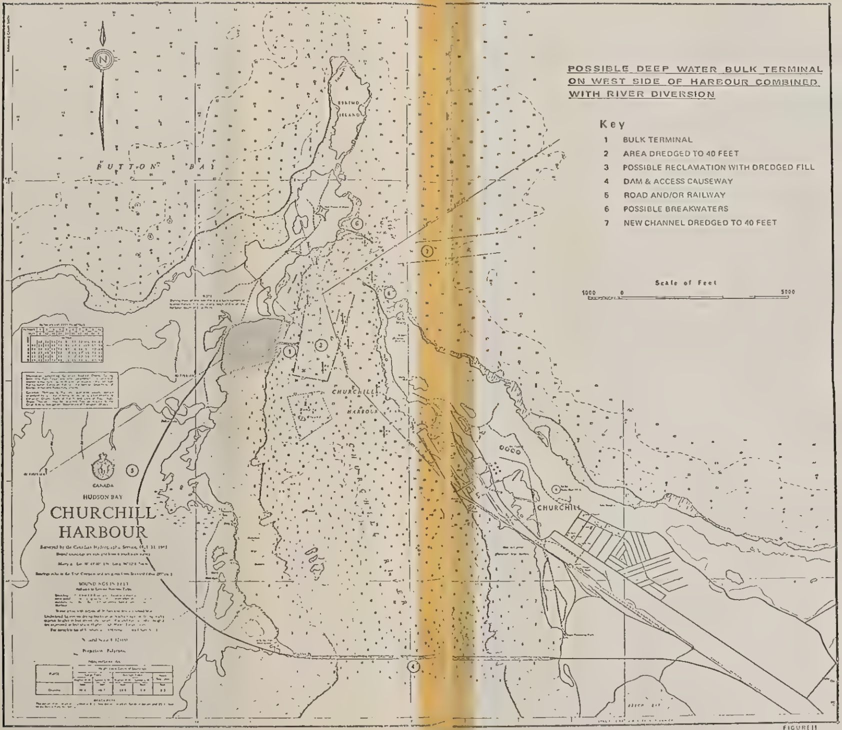
POSSIBLE DEEP WATER BULK TERMINAL ON WEST SIDE OF HARBOUR COMBINED WITH RIVER DIVERSION
Key
1 BULK TERMINAL
2 AREA DREDGED TO 40 FEET
3 POSSIBLE RECLAMATION WITH DREDGED FILL
4 DAM & ACCESS CAUSEWAY
5 ROAD AND/OR RAILWAY
6 POSSIBLE BREAKWATERS
7 NEW CHANNEL DREDGED TO 40 FEET
Scale of Feet
1000 0 5000
BUTTON BAY
CHURCHILL HARBOUR
CHURCHILL
CANADA
HUDSON BAY
CHURCHILL HARBOUR
SOUNDINGS IN FEET

FIGURE 11

1. That the coastal berth, the north end of the Dalgliesh berth and occasionally the Wolfe berth will be used for berthing two coastal vessels or vessels of the Canadian Coast Guard Service.

2. That either the whole or part of the Dalgliesh berth, part of berth 1 and occasionally the Wolfe berth will be used for vessels discharging inbound general cargo or loading moderate quantities of forest products and minerals.

3. That the remainder of berth 1 and berths 2 and 3 will be used almost exclusively to accommodate two vessels loading grain.

b. Grain - As can be seen from Figure 3[6], records of the four years 1964-1967 show that on the average at least one vessel was berthed ready for loading grain on an average of 69 days out of the official 82 day season. Two vessels were berthed ready for loading grain on an average of 44 days out of 82. In 1965 when 24.7 million bushels of grain were loaded the figures were 77 days for one vessel and 48 days for two vessels and four out of the five days when no vessel was berthed were at the beginning of the season from July 26 to 29.

In a season of high demand it would be reasonable to assume one vessel available for loading grain 85 per cent of the time and two vessels available 55 per cent of the time. With two vessels available an effective loading rate of 52,000 bushels per hour could be achieved but with only one vessel this rate might be reduced to about 36,000

[6]Figure 3 Chapter 1.

bushels per hour to allow for trimming and bulkheading. On this basis the effective loading over two grain berths during an 82 day season would be:

6 days/week, 8 hours/day	22.2 million bushels
7 days/week, 12 hours/day	38.7 million bushels
7 days/week, 16 hours/day	51.6 million bushels
7 days/week, 24 hours/day	77.4 million bushels

c. Forest Products - Forest products in moderate quantities could conveniently be loaded at the more northerly of the four main berths. Assuming that forest products would be either bundled, packaged or unitized in units of reasonable size, and that the operation on the wharf and in the ship would be largely mechanized, it should be possible to handle in the order of 30 tons in each hatch per hour.

Assuming an average of four hatches being worked at any one time and a berth occupancy of 50 per cent, it would be possible to load the following quantities of forest products in an 82 day season:

6 days/week, 8 hours/day	33,700 tons
7 days/week, 12 hours/day	59,000 tons
7 days/week, 16 hours/day	78,000 tons
7 days/week, 24 hours/day	118,000 tons

d. Base Metals - The potential export of base metals is likely to be in the form of refined metals and concentrates. The rapidity of loading will depend on the form in which the metals and concentrates

are to be handled. This in turn will depend on the quantities involved and the justification for special packaging and mechanical handling equipment.

In view of the relatively small potential quantities which are forecast for shipment through the Port in the future, it is assumed that no special bulk loading facilities will be provided, and that the metals or concentrates will be loaded in some form of unit packages by crane or ship's gear.

Assuming also that the unit packages will be of reasonable size, it should be possible to achieve a loading rate of 30 tons per hatch per hour as for forest products, and the same total loadings over one berth in an 82 day season. However, the two berths over which forest products and base metals will be loaded will also be required for unloading inbound general cargo and the possible combined loadings will be reduced accordingly.

e. Inbound General Cargo - Unless it is found economically feasible to containerize or unitize a fair proportion of the inbound general cargo, the average unloading rate would probably be in the order of 15 tons per hour per hatch. In view of the fact that the general cargo is likely to come in fairly small consignments, it is unlikely that on the average more than two hatches will be worked simultaneously.

If it is assumed that two berths are available both for unloading general cargo and for loading forest products and minerals, it would be possible with 50 per cent berth occupancy to discharge the following tonnages of general cargo in an 82 day season.

Operating Period	No Minerals or forest products	20,000 T m. & f.p.	50,000 T m. & f.p.
6 days/week, 8 hours/day	16,800	11,800	4,300
7 days/week, 12 hours/day	29,600	24,600	17,100
7 days/week, 16 hours/day	38,400	33,400	25,900
7 days/week, 24 hours/day	59,200	54,200	46,700

It is considered that the occasional tanker discharging oil at the Dalgliesh berth will not significantly affect the above tonnages.

f. Coastal Loadings - Churchill Harbour is free of ice for several weeks before ocean going vessels are at present able to arrive, and it is possible, therefore, to load some coastal vessels before the normal season if these vessels are wintered at Churchill.

On the other hand, since the coastal vessels serve settlements in Hudson Bay, Hudson Strait and the Arctic, they would have to load in time for the return journey to Churchill before the Harbour is closed by ice. This would mean the completion of loading by about September 25 on the average, giving a loading period beyond July 6 of about 6C days.

Assuming a loading rate of 15 tons per hour per hatch with an average of two hatches working and 50 per cent occupancy of two berths, it would be possible to load the following quantities during this period, to which could be added preseason loadings of about 5,000 tons.

6 days/week, 8 hours/day	12,300 tons
7 days/week, 12 hours/day	21,600 tons
7 days/week, 16 hours/day	28,800 tons
7 days/week, 24 hours/day	43,200 tons

Port Facilities Relative to Traffic Potential

The capability of the existing grain handling and port facilities are summarized and compared with the potential traffic in 1985 assuming a continuation of the present navigation season are shown in Table 43. It can be seen from this table that the existing facilities are adequate to handle all potential commodities up to 1985. However, in the case of grain, the present procedure of working one shift with overtime will not suffice as far as cleaning is concerned. Unless there is a major change in the grades of grain exported or in the standards governing impurities the present cleaning equipment will have to be operated almost continuously to pass the potential 1985 tonnage.

If, for any reason, continuous operation of the grain cleaners is not practicable, it will be necessary to consider one or a combination of the following possibilities:

a. Explore with the Board of Grain Commissioners the possibility of lowering the standards governing the impurities in the Manitoba Northern wheat exported through Churchill or adjusting the grading so that one pass through the cleaning equipment will generally suffice.

b. Explore with the Board of Grain Commissioners the possibility and cost of undertaking more cleaning at inland elevators.

TABLE 43

PORT OF CHURCHILL - CAPABILITY OF EXISTING PORT FACILITIES

Item	1985 potential[1]	Traffic in Thousands of Short Tons for 82 Day Season — Present Capability: 6 d./wk. 8 hr./day	7 d./wk 12 hr/day	7 d./wk. 16 hr./day	7 d./wk. 24 hr./day
Grain	909	443[a]	636[a]	835[a]	1,180[a]
Forest Products	-	20[b]	20[b]	20[b]	20[b]
Base Metals	15				
Potash	-	-	-	-	-
Petroleum outbound other than coastal	-	-	-	-	-
Petroleum products, inbound[2]	40	40+	40+	40+	40+
General cargo, inbound[2]	18	12	25	33	54
Coastal shipping	15	17	27	34	48

[a] As limited by cleaning process and including 150,000 tons in store at beginning of season

[b] Or greater quantities with reduced inbound general cargo.

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[1] See Chapter 10, Table 39, p. 113; the potential is based on the present navigation season.

[2] In Table 39, p. 113 petroleum products and general cargo are combined.

c. Install additional storage and conveying equipment so that more grain may be cleaned outside the shipping season.

d. Install additional cleaners and related equipment, -- if necessary in a supplementary workhouse area.

e. If, after 1973 the diversion of the Churchill River at Southern Indian Lake, has not solved the slush ice problem, undertake measures to do this so that the shipping season may be extended about three weeks beyond the present date on which insurance at normal rates expires.

It is not possible without considerable further detailed study to say which of the above possibilities or combination of possibilities is likely to be the most economical solution. However, the following general comments are relevant:

a. Lowering the grade of wheat by allowing more impurities would result in a lower price per bushel and this loss would have to be compared with the cost of additional storage or cleaning facilities.

b. Additional cleaning at inland elevators would require double handling and additional cost which would have to be compared with the cost of new facilities.

c. Simple additional storage in the form of steel bins and related conveying equipment would probably cost about $1.75 per bushel for an installation, having a capacity of 5 million bushels. Additional cleaning equipment in a supplementary workhouse would almost certainly cost less than this.

d. Extending the shipping season by about 23 days, although permitting a 25 per cent increase in potential grain throughput, is not really comparable with the other possibilities. This is because an extended season would tend to increase the market potential and, if advantage were to be taken of this, one or more of the other possible solutions to the cleaning problem might still be required.

Conclusions Re Present Port Facilities

In conclusion it is not considered that any increase in the facilities at the Port of Churchill is required at the present time. If it eventually becomes apparent that cleaning is likely to limit grain exports, a detailed study should be made of all possibilities discussed above.

CHAPTER 16

A PRACTICAL PROGRAMME FOR FURTHER DEVELOPMENT

A Two Phase Programme

To date, development of the Port of Churchill has been impeded by a combination of physical and economic obstacles which have limited the commodity traffic handled at the port. The length of time the port is open is substantially less than the other Canadian ports through which the major portion of commodity import and export traffic to or from offshore areas move. Consequently, since its beginning the port has been utilized mainly for the export of wheat from Western Canada to the traditional markets in the United Kingdom and Western Europe. Because of the short season and the economic characteristics of the Hinterland, other types of export, import and coastwise traffic have been limited to a rather small volume.

An examination of the potential demand and supply of materials and products in the Port's Hinterland in the future was made relative to a) the competitive position of Churchill compared to other Canadian ports, b) the possible use of new technological forms of transportation and c) extending the navigation season. Based on this examination it is concluded that the most technically and economically feasible way in which port utilization could be increased in the future would be to extend the period of time in which the

the port remains open to navigation by approximately three weeks from the present 82 to 105 days. The least costly way in which the navigation season might be lengthened to this extent would be to remove the early ice problem at the wharfs which occurs in the fall. This problem is created by the early formation of slush or frazil ice in the Churchill River above the port. The weight of this ice carried by the river current to the wharfs at the port can force ships from their moorings.

There is a distinct possibility that the problem created by frazil ice in the river will be solved in part or completely when some of the water flow of the river is diverted to the Nelson River system as part of the Manitoba Hydro's power development at Kettle Rapids. Whether this problem will or will not "solve itself" will be known in 1973. Because of this possibility a two phase development programme is recommended for the Port of Churchill:

a. The first phase would consist of a short term traffic promotion programme to 1973 involving a minimum investment and the continuation of the present navigation season.

b. The second phase would be a long term development programme which might be implemented after 1973 and which would involve an extension of the navigation season to 105 days and which could involve a more substantial investment.

First Phase: Development Programme (to 1973)

Until the frazil ice is eliminated, on the basis of past

experience it is evident that the Port can remain open with minimal risk to navigation from ice hazards approximately 82 days. For the duration of this short term development programme the Port operating season would remain the same as it has in the past. Such a development programme to 1973, involving minimum investment would be directed to increasing Port traffic within the present operating season to the point where the Port facilities are operating at capacity.

In the past the short navigation season, the availability of markets and forwarding costs, have all to some extent limited the volumes of commodities handled at the Port. The movement of all commodities are restricted by the short season. Available markets and all the commodity movements except for grain and a portion of the coastal shipping are directly influenced by the inland and ocean forwarding costs. In the case of supplies carried to northern settlements from Churchill, demand is the important factor and not forwarding costs. The volume of wheat exports moving through the Port from the Churchill Hinterland can be considered as the only Port traffic which has not been entirely restricted by actual forwarding costs and market demands during the Port operating season.

Wheat exports through Churchill are influenced by the pricing policy of the Canadian Wheat Board. In 1954 the Wheat Board adopted a policy to make Canadian wheat exports generally competitive irrespective of the port from which it was shipped. In administering this policy the Wheat Board fully considers total inland and ocean forwardings costs to all major export markets and

establishes prices for wheat in store at the Lakehead, Vancouver and at Churchill. The adjustment in the price of wheat offered through the Port of Churchill eliminates much of the forwarding cost advantage which could be gained by a buyer in either the United Kingdom or Western Europe where the in store price is based upon actual forwarding costs through Churchill.

Average forwarding costs from 1961-1962 through 1965-1966 for wheat moving from a mid-prairie point to the United Kingdom were a) via Churchill approximately 46.4 cents per bushel and b) through the St. Lawrence via the Lakehead approximately 56.7 cents per bushel. This mid-prairie point is representative of the Churchill Hinterland.[1] Actual savings in forwarding cost for wheat exported through the Hudson Bay Route rather than the St. Lawrence has averaged 10.3 cents per bushel.

However, during this same period average in store prices established by the Wheat Board for Number 2 Northern have been $2.013 per bushel and $1.952 per bushel respectively for Churchill and the Lakehead. Forwarding costs from the above in store positions to the United Kingdom have averaged 27.2 cents per bushel via Churchill and 38.3 cents per bushel via St. Lawrence. Consequently,

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[1]Scott, Saskatchewan.

the total cost to a buyer in the United Kingdom, for Number 2 Northern is estimated to have averaged $2.285 per bushel through Churchill and $2.335 per bushel through the St. Lawrence and the saving to the buyer ordering through Churchill rather than through the St. Lawrence has only averaged 5.0 cents per bushel. Buyers in Western Europe are generally able to realize the same savings.

Therefore, of the total savings in actual forwarding costs which can be gained by wheat exports to the United Kingdom through Churchill, only about 50 per cent goes to the buyer. At the 5.0 cents per bushel cost saving which a buyer in the traditional markets can generally realize, buyers traditionally have remained hesitant and have never ordered sufficient wheat through Churchill to test the capacity of the Port.

It is not considered that it would be in the public interest to increase the capacity of the Port until such expansion was required to accommodate traffic which would in fact materialize. In the past total Port traffic has been adequately handled without operating the Port facilities to the limit of their capacity. In light of this, it is considered that the period up to 1973 should be used to assess the present working capacity of the Port within the existing operating season and to determine if traffic could be increased in response to market forces.

Increasing wheat exports through the Port would be the most rational way in which the Port could achieve maximum capacity. Wheat is the single major commodity which now moves through the

Port in volume. Wheat exports are directly influenced by public policy and so could be used to test the reaction of the market to lower prices at the Port.

If the United Kingdom and Western European markets were offered a greater cost saving for wheat ordered ex Churchill, it is reasonable to assume that the present buyer hesitance in regard to this Port would be removed to some extent. One way in which this cost saving could be achieved would be through a downward adjustment in the in store pricing system as it applied to Churchill. The increased savings thus provided to buyers would compensate them for higher ocean insurance costs, storage costs in Western Europe and costs which might be incurred by shipping delays. The downward adjustment need only be enough to increase exports to the capacity of the Port.

Once the capacity of the Port is reached, the full implications to national policy of any further expansion programme could be fully assessed before undertaking the second phase of development after 1973.

Second Phase

The grain cleaning facilities as they now exist may in the future become a bottleneck and limit the Port's capacity to handle projected grain exports. A difficulty in the processing of wheat through the terminal elevators has been to clean to the standards which are now required by the Board of Grain Commissioners. Wheat currently exported

through the Port is comprised largely of Number 2 Northern. The established standards of this grade are quite high and before the wheat can be loaded on vessels it must at times be passed two or three times through the cleaning facilities. This problem may in the future be reduced by a change in the grading standards, which is now being considered, or by exporting substantial quantities of grains requiring less thorough cleaning as in the case of feed grains.

If after 1973 the problem of frazil ice in the harbour solves itself and the cleaning bottleneck is removed by a change in the types of grain handled, a different grading system or an expansion of the cleaning facilities, capacity would increase.

With the bottleneck removed, the most probable export potential of the Hinterland could be handled by the rail and ocean transportation systems within a port operating season of 105 days extended to November 7th. No investment would then be required for icebreakers and vessels with ice strengthened hulls. Thus with a short extension and minimum investment Port traffic could potentially increase to a level of almost 1.7 million tons by 1985.

It is expected that even though there would be no physical limitations in handling the grain export potential of the Hinterland, there could still be some buyer hesitancy to ordering such volumes as forecast for 1985 in this short period of time. If this were to be the case, perhaps increased incentives through allowing buyers to gain a greater forwarding cost advantage would have to be provided

to achieve the Port's maximum grain export potential. Unless it was found desirable to extend the season past November 7th for strategic or defence reasons, at a minimum the only new investment required would be for expanded cleaning facilities and possibly a tidal barrier to divert the river current. However, if present trends in shipping technology continue perhaps major investments in Port facilities to accommodate significantly larger ships will be needed in order to maintain the competitiveness of the Port.

TABLE 44

PROJECTED POTENTIAL TRAFFIC
RECOMMENDED DEVELOPMENT PROGRAMME
(thousand tons)

	Phase 1	Phase 2		
	1970-1973	1975	1980	1985
Grain	909	1,400	1,500	1,600
Forest Products	-	-	-	-
Base Metals	15	15	15	15
Petroleum	-	-	-	-
Potash	-	-	-	-
General Cargo	58	58	58	58
Coastal Shipping	15	15	15	15
Total	997	1,488	1,588	1,688

Source: Hedlin, Menzies & Associates Ltd.

Recommendation

It is therefore recommended that any direct development expense at the Port be delayed until at least 1973 when the results of the first phase development programme can be assessed and the

implications to regional and national interests determined. Initial development activity should be directed to examining and implementing the means by which grain exports through Churchill can be increased to the present working capacity of the Port within the existing navigation season. The most direct method would be to allow buyers a greater forwarding cost advantage relative to other Canadian ports.